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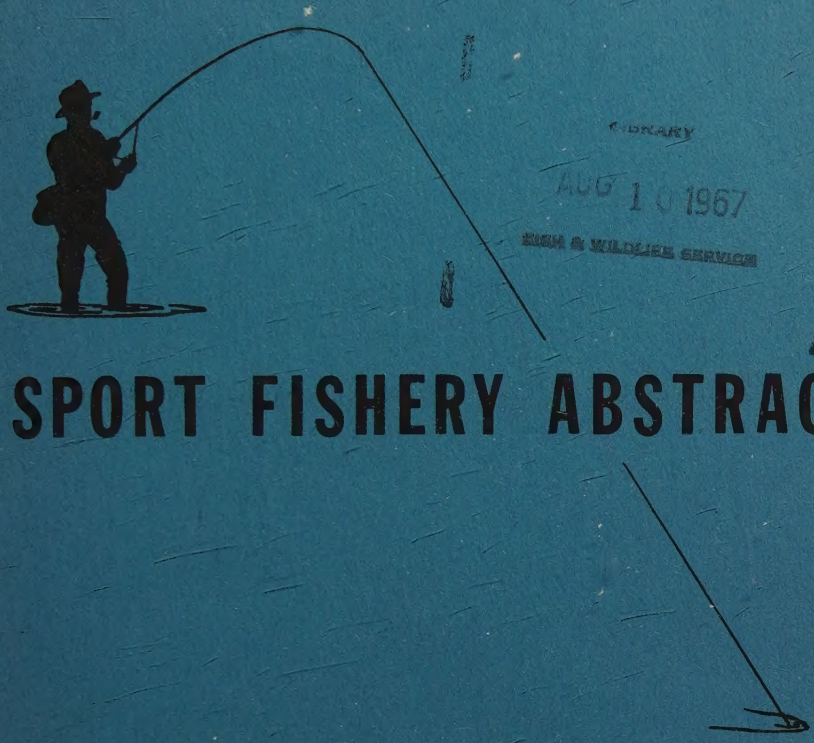

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SPORT FISHERY ABSTRACTS

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BUREAU OF SPORT FISHERIES AND WILDLIFE

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Vol. 11, No. 4 Abstracts 8901-9025 1966

Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

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Washington, D. C. 20240

8901. Kitaev, S. P. 1964. USE OF POLYCHLORPINENE TO PREPARE LAKES FOR STOCKING UNDER KARELIAN CONDITIONS. In: Karelian fisheries. Petrozavodsk. 8. 31-39. From: Ref Zh Biol, 1965, No. 4I88. (Translation); Biological Abstracts, 47(16): Abst. No. 75739. 1966.

A 50% solution of polychlorpinene in diesel fuel was used as an ichthyocide. In 1960 and 1961 two series of experiments were carried out in 10 lakes with a total area of 60 ha. In one of the series the polychlorpinene concentration was allowed to vary (0.20, 0.15, 0.10 and 0.07 mg/l) while the water surface temperature remained the same; in the other series, the polychlorpinene concentration remained the same (0.15 mg/l) while the temperature varied. In 1962 experiments were carried out to determine the effect of 0.1 mg/l polychlorpinene at a low water temperature at the time of treatment, and also at subsequent rising temperatures. Also, experiments were conducted to ascertain the minimal concentration of polychlorpinene that would kill the fish but leave the food supply intact. At the same water temperature in the lakes, the time until death was reduced by increased concentrations of polychlorpinene, the minimal concentration ranging from 0.05 to 0.10 mg/l at a water temperature of 16-20° C. At the same concentration of polychlorpinene (0.15 mg/l), but at different temperatures, the time until death depended on the temperature: the higher the temperature, the shorter the time until death. With lower temperatures the time until death increased. In spring, the optimal polychlorpinene concentration was 0.10-0.12 mg/l at 7-12° C, and 0.07 - 0.10 mg/l at 18° C or higher; in fall, at a water temperature of 15° C or less, it was 0.15-0.18 mg/l. The effectiveness of polychlorpinene depended also on the extent of plant overgrowth, on the development of zoo- and phytoplankton, the pH of the water, the degree of humification and on other factors. (Auth.)

8902. Novikov, P. I., and T. D. Gosheva. 1964. BIOLOGICAL STUDIES OF ATLANTIC SALMON OF THE PECHORA RIVER. In: Contributions to the session of the Scientific Research Institute of Marine Fisheries and Oceanography on the results of the investigations conducted in 1962 and 1963. Murmansk. 190-193. From: Ref Zh Biol, 1965, No. 4I52. (Translation); Biological Abstracts, 47(16): Abst. No. 75757. 1966.

The Pechora Atlantic salmon performs feeding migrations to the coasts of Norway. On entering the Pechora, they orientate themselves to the current. Tagging during the period 1960-63 showed that the stock numbered 80,000 in 1962, and about 50,000 in 1963. The average speed of the migration in the Pechora delta was nearly 25 km in 24 hours. In 1963 the salmon averaged 85 cm in length; the entire run was dominated by females (to 70%) aged 5+ and 6+. In 1960, second-time spawners comprised 9% of the run. The largest catches were recorded at moderate and high water levels. (Authors)

8903. Persov, G. M. 1964. ON THE QUESTION OF THE SEX RATIO IN YOUNG OF PINK SALMON. In: Contributions to the session of the Scientific Council of the Polar Scientific Research Institute of Marine Fisheries and Oceanography on the results of the investigations conducted in 1962 and 1963. Murmansk. 173-178. From: Ref Zh Biol, 1965, No. 4I53. (Translation); Biological Abstracts, 47(16): Abst. No. 75759. 1966.

In young of pink salmon during the river period there was a predominance of males in odd years (1961, 1963) and of females in even years (1962, 1964). The phenomenon was observed for young hatched on fish-farms and for young hatched on natural spawning grounds. (Auth.)

8904. Zaitsev, Yu. P. 1964. CONTRIBUTIONS TO THE BIOLOGY OF THE SPAWNING PROCESS OF BLUEFISH (Pomatomus saltatrix) IN THE BLACK SEA. Nauk Zap Odes'koyi Biol Sta Akad Nauk Ukr SSR 5. 100-101. (Russ. summ.). From:Ref Zh Biol, 1965, No. 4I57. (Translation); Biological Abstracts, 47(16): Abst. No. 75790. 1966.

On the basis of studies of samples gathered in the subsurface layer, the author has obtained data on the localities and condition of eggs and larvae of bluefish in the western part of the Black Sea. The eggs generally are shed far from

the shores and accumulate in the subsurface layer. As the larvae grow, they approach the shores, feeding on large zooplankton organisms which form aggregations. (Auth.)

8905. Zarnecki, Stanisław (State Counc. Protect. Natur., Warsaw, Poland). 1963. COMPENSATING FOR LOSSES IN FISHERIES CAUSED BY HYDRO-ELECTRIC PLANTS. Chronmy Przyrode Ojczysta 19(6): 27-38; Biological Abstracts, 47(16): Abst. No. 75792. 1966.

Salmon trout, due to restocking has became more abundant than formerly. Vistula salmon, the largest salmon in the world, continues to thrive. Protection of fishes involves three basic measures: 1. construction of fish ladders; 2. organization of breeding ponds; 3. preventing fish from migrating downstream to destruction on hydraulic turbines. Compensation of losses in the fish population is most important as regards anadromous salmonids. --Courtesy NSF (PL 83-480) 1966.

8906. Heath, Alan G., and Austin W. Pritchard (Virginia Polytechnic Inst., Blacksburg, Va.). 1965. EFFECTS OF SEVERE HYPOXIA ON CARBOHYDRATE ENERGY STORES AND METABOLISM IN TWO SPECIES OF FRESH-WATER FISH. Physiol. Zool., 38(4): 325-334. Illus.; Biological Abstracts, 47(16): Abst. No. 76068. 1966.

Bluegill sunfish, Lepomis machrochirus, and cutthroat trout, Salmo clarki, were exposed to a rapidly declining O_2 tension for a period of time sufficient to just cause loss of equilibrium in the fish. During recovery from the stress, measurements of O_2 uptake, blood lactate, blood glucose, liver glycogen, and muscle glycogen were made at fixed intervals of time. Hypoxia caused an immediate rise in blood lactate and O_2 uptake in both species, but the trout showed the greatest increases. This suggests a greater degree of O_2 debt in the latter, even though the stress routine used in this species was not as prolonged. A delayed peak in the blood lactate observed in the trout, but not in the bluegill indicated a possible impairment of circulatory function in the trout. The blood lactate returned to normal after 2 and 5 hours in the bluegill and cutthroat, respectively. The return of the O_2 uptake to control levels required 8 and 10 hours, respectively. An immediate mobilization of the carbohydrate stores occurred during the stress in both the bluegill and trout. The blood glucose concentration rose greatly in the bluegill but not in the trout. (Authors)

8907. Hane, Satoshi, O.H. Rovertson, Bernard C. Wexler, and Marcus A. Krupp (Univ. of California, School of Medicine, San Francisco, Calif.). 1966. ADRENOCORTICAL RESPONSE TO STRESS AND ACTH IN PACIFIC SALMON (Oncorhynchus tshawytscha) AND STEELHEAD TROUT (Salmo gairdnerii) AT SUCCESSIVE STAGES IN THE SEXUAL CYCLE. Endocrinology 78(4): 791-800. Illus.; Biological Abstracts, 47(16): Abst. No. 76800. 1966.

With the purpose of acquiring information concerning the functional activity of the adrenocortical tissue of the Pacific salmon (O. tshawytscha) during various stages of its migration from the sea to the spawning grounds, ACTH administration, the stress of holding in a confined space and repeated bleeding were employed to determine the response of the adrenocortical tissue as reflected in the changing concentration of 17-hydroxycorticosteroids (17-OHCS) in the blood plasma. The stress of holding sea salmon in a tank on board ship, without other disturbance, resulted after 1 hour in a progressive rise in plasma 17-OHCS to as much as a 4-fold increase by the end of 24-48 hours. This change was accompanied by hyperplasia of the adrenocortical tissue. At the beginning of the salmon's river migration, both holding alone plus bleeding and ACTH injection produced a marked increase in plasma 17-OHCS, but not quite as great as that shown by salmon taken in the sea. Thereafter, as the salmon continued their migration and maturation of the gonads, their adrenocortical reactivity diminished progressively until, by the time of spawning, little response to ACTH or stress could be elicited. At this terminal period in the salmon's life cycle the levels of 17-OHCS in the plasma remained high. Except at the beginning of their fluvial migration, females, both

maturing and spawning, exhibited higher plasma concentrations of 17-OHCS than did male salmon. Spawning steelhead trout showed a higher rise in plasma corticosteroid levels than did spawning salmon following ACTH injection. (Authors)

8908. Lindsay, Raymond H., Cynthia Romine, Frank Zacharewicz, Harry K. DuPree, and Kermit E. Sneed (Veterans Admin. Hosp., Birmingham, Ala.). 1966. ACCUMULATION OF I^{131} BY CHANNEL CATFISH (Ictalurus punctatus) OVARIES in vivo AND in vitro. Gen Comp Endocrinol 6(2): 231-238. Illus.

Ovaries of channel catfish (Ictalurus punctatus) were found to concentrate I^{131} with accumulation reaching a peak 20-30 hours after injection. A major portion of the injected I^{131} was recovered in the ovaries which accounted for 45.0% of the injected dose after 24 hours while the thyroid accounted for only 2.43%. Accumulation of I^{131} in the ovaries occurred against a concentration gradient with ovary to blood ratios after 24 hours of 32:1. Accumulation of I^{131} was also demonstrated by ovarian tissue in vitro with tissue to medium ratios as high as 96:1. Concentration of I^{131} in vitro was inhibited by 2,4-dinitrophenol, sodium perchlorate, and sodium thiocyanate, but was not affected by methimazole or thiouracil. The I^{131} in fish ovaries accumulated in vitro appeared to be predominately in an inorganic form. However, seasonal variations were noted in which I^{131} uptake by ovaries obtained in June, as opposed to those obtained in January, appeared to be more firmly bound to the tissue. Traces of I^{131} were present in the protein band after electrophoresis of tissue homogenates and 2-5% of the I^{131} was associated with protein after paper chromatography. (Authors)

8909. Vernon, E.H. 1966. ENUMERATION OF MIGRANT PINK SALMON (Oncorhynchus gorbuscha) FRY IN THE FRASER RIVER ESTUARY. Internatl. Pacific Salmon Fish. Comm. Bull. 19. 1-83. Illus. Maps; Biological Abstracts, 47(17): Abst. No. 80657. 1966.

Seaward migrant pink salmon fry of the Fraser River system emanate from tributary and main stem spawning areas situated immediately above the estuarial portion of the river and therefore estimation of total fry production entailed development of techniques for consistent sampling of fry abundance throughout the migration in a section of the river subject to tidal fluctuations. To circumvent tidal fluctuations in stream flow, a pontoon-mounted trap was propelled upstream at 2.5 ft/sec for 15 minute periods by a power boat. Resultant data were augmented by operating a similarly propelled gear fitted with conical nets which could be fished to depths of 13.5 ft. At greater depths, data were obtained from a stationary net. On the basis of data obtained on lateral, vertical, and diurnal distribution of fry, the daily trap samples were weighted so that they were representative of fry numbers per unit volume of water during each 24-hour period. Daily fry abundance was then determined from the daily volume of net seaward river flow as estimated at discharge gauging stations situated above tidal influence. The total number of fry was estimated to be 143.6 million in 1962 and 284.2 million in 1964, indicating a freshwater survival of 9.2% and 11.7%, respectively. (Auth.)

8910. Wilson, Peter C. (Bur. of Commercial Fisheries, Gloucester, Mass.). 1965. REVIEW OF THE DEVELOPMENT OF THE ATLANTIC COAST TUNA FISHERY. Commercial Fisheries Review, 27(3): 1-10.

Bluefin tuna (Thunnus thynnus) are seasonally abundant along the New England coast where they have been of minor commercial importance for many years. In 1951 the U.S. Fish and Wildlife Service began investigating that resource to determine whether a New England tuna fishery was feasible. The results of those investigations showed that several different species of tuna were present in the Northwest Atlantic beyond the U.S. Continental Shelf. The Fish and Wildlife Service sponsored purse-seine trials in 1951 and 1954, and the 1958-61 operations of a commercial vessel (with which the Service's Bureau of Commercial Fisheries cooperated) demonstrated that commercial quantities of bluefin tuna could be harvested in New England waters. During 1962 and 1963 the new tuna fishery had a purse-seine fleet of 16 United States and 2 Canadian vessels. The season lasted 5 months and the fishing area included all of the Continental Shelf from

Virginia to Massachusetts. A skipjack (Euthynnus pelamis) resource was also discovered. In 6 years the Atlantic Coast tuna purse-seine catch rose to 9,000 short tons, including 3,000 tons of skipjack. (Auth.)

8911. Thommen, H., and U. Gloor (F. Hoffmann La Roche Co., Basle, Switzerland). 1965. ON THE OCCURRENCE OF KETO-CAROTENOIDS IN THE TROUT. Naturwissenschaften 52(7): 161-162; Biological Abstracts, 47(17): Abst. No. 80716. 1966.

Column-chromatographic analyses of flesh homogenates of freshly caught Salmo trutta showed the presence of beta-carotene, astaxanthine, and canthaxanthine, but no echinone. The liver, gastrointestinal apparatus contained only trace amounts of the above substances. --J. Grauman.

8912. Lofts, Brian, Grace E. Pickford, and James W. Atz (St. Bartholomew's Hospital Medical College, Univ. London, London, England). 1966. EFFECTS OF METHYL TESTOSTERONE ON THE TESTES OF A HYPOPHYSECTOMIZED CYPRINODONT FISH, Fundulus heteroclitus. Gen Comp Endocrinol 6(1): 74-88. Illus.; Biological Abstracts, 47(17): Abst. No. 81490. 1966.

Administration of methyl testosterone to hypophysectomized, sexually regressed, male Fundulus heteroclitus (2 μg/g, thrice/week) initiated the development of nuptial coloration within 2 weeks. Stimulation of spermatogenesis was evident after 4 weeks, and at 8 weeks free spermatozoa were present in the efferent ducts of 4 out of 6 fish. Although the gonadosomatic index was significantly increased, testis size was one-tenth that of intact males in the breeding season. Eight-week treatment also caused hypertrophy of the epithelium of the efferent ducts and restored the atrophied cells to near normal breeding condition. A lower dose of methyl testosterone (0.2 μg/g) for 8 weeks caused essentially similar changes in the testes, but the development of nuptial coloration (attributed to direct action of the androgen) proceeded more slowly. (Authors)

8913. Dönges, Johannes. 1965. THE LIFE CYCLE OF Posthodiplostomum brevicaudatum (Trematoda), A PARASITE IN THE EYES OF FRESHWATER FISHES. Zoologica (Stuttgart) 40(4): 1-39. Illus.; Biological Abstracts, 47(17): Abst. No. 84435. 1966.

In May 1958, a previously undescribed sp. was found on the snails Tropidiscus carinatus and T. planobis, in the Federsee. It was discovered that when it was introduced into the serum of humans suffering from bilharziosis, it reacted by building a casing. This reaction led to further study of larva in the laboratory. It was discovered that it attacked fish and amphibian larvae, but was able to develop only in fish larvae. A few hours after the invasion the cercaria fixes itself in the eyes of the fish, particularly in the tapetum or retina. Here there is a growth phase lasting about 3-1/2 weeks, after which it encysts itself. Cysts of metacercariae of Neascus type were observed in minnows in June 1959. The symptoms of the parasitized fish were observed at the same time as the development of the metacercariae. In order to bring the metacercariae to the adult stage it was necessary to find a warm-blooded host. It was finally possible to bring the parasite to maturity in ducklings and chicks of the laughing gull. Finally, the adults were identified as Posthodiplostomum brevicaudatum Kozicka (originally Holostomum b. v. Nordmann=P. impraeputiatum Dubois). In this paper, the morphology of the developmental stages is described in detail, with many illustrations and tables of data. Under natural conditions, the parasite achieves sexual maturity in the hosts Ardea cinerea or Ixobrychus minutus. It is possible for the entire life cycle to be completed in 80 days under favorable conditions, but if ecological conditions are unfavorable, it may take 4 years or more. The chief growth stages take place while the parasite is in the fish. It requires only 44-60 hours in the final host to complete the cycle. --A. K. Winner.

8914. Ergens, Radim. 1965. THE PARASITOFAUNA OF FISHES IN THE RIVER OSOBLAHA. Cesk Parazitol 12. 145-169. Illus. (Ger. summ.); Biological Abstracts, 47(17): Abst. No. 84438. 1966.

In parasitological studies of 160 fish (14 species) from the Osoblaha River (Oder tributary), 59 species and subspecies of parasites were found: 7 spp. of Protozoa, 28 of Mongenoidea, 10 spp. of Trematoidea, 4 spp. of Cestoidea, 5 spp. of Nematoda, 2 spp. of Acanthocephala, and 1 sp. each of Hirudinea, Mollusca, and Crustacea. The high parasitic stage of a typical host by a specific parasite causes an enduring and severe infection of the environment at the invasion stage of the parasite. Considering this, the parasite was also found on atypical hosts. (Rhabdochona denudata in Trutta trutta m. fario and Sterliodochona ssavine in Perca fluviatilis). The findings confirm the results of the studies of Erhardova (1957), Ryšavý and Michalek (1957). Endoparasitosis in fish, which are nourished exclusively or largely by plants, are not excluded especially where sufficient benthos is present, whose representatives are or can be intermediate hosts of the parasites. In the parasite fauna of the Osoblaha River species predominate which parasitize more than one species, whereby a proportionately great possibility of an exchange between the parasite fauna between the individual fish species arises. From a zoogeographical standpoint the parasite fauna of the fish of the Osoblaha River from the waters of the Oder is not qualitatively different from the parasite fauna of the fish of the waters of the Elbe and Danube. (Auth. summ. transl.)

8915. Wimpenny, R.S. 1966. THE PLANKTON OF THE SEA. American Elsevier Publishing Co., Inc.: New York. 9+426 p. Illus., Pr. $16.00.; Biological Abstracts, 47(18): Abst. No. 85677. 1966.

The depths and distances of the sea form an immense theater for its floating animals and plants which are called plankton. These mainly microscopic creatures form a dense population in the apparently empty sea and upon them all the rest of marine life, including commercial fish and the largest whales, depend ultimately for food. The author describes this setting and the interrelations, distribution and behavior of the fascinating planktonic actors. Examples of all the animal and plant groups concerned are illustrated, and for the most important group of plants —the diatoms—almost all the known species are shown. The book is, however, intended also for the student who needs certain precise information to meet the demands of examiners and of his career. So, in the later chapters, details are given on plankton and the productivity of the sea—its role in the production of fuel oil—on explanations of form and distribution and on the techniques employed. An especially long look has been taken at the effect of climate and water movements on the way the organism adapts itself.

8916. Kitaev, S.P. 1964. THE EFFECTIVENESS OF POLYCHLORPINENE IN RELATION TO ITS CONCENTRATION AND ENVIRONMENTAL CONDITIONS. Izv Gos Nauch-Issled Inst Ozern Rechn Rybn Khoz 57: 179-182. From: Ref Zh Biol, 1965, No. 9I75. (Translation); Biological Abstracts, 47(18): Abst. No. 85710. 1966.

The effect of polychlorpinene on fish was investigated in 10 mesotrophic and mesotrophic-distrophic lakes of different sizes, inhabited by perch, roach and pike. At a chloropinene concentration of 0.15 mg/l and a surface water temperature of 23° C, the fish died in about 1 day; at 18° followed by an increase to 23° they died in 6 days; at 14° followed by lower temperatures they died in 20-30 days; at 6°, they died in 10-60 days. At the same temperature (nearly 23°) and at a polychlorpinene concentration of 0.15 to 0.20 mg/l the majority of the fish died in 1 day; at a concentration of 0.10 mg/l, in 2 days, and at 0.07 mg/l in 7 days. A graph showing the effect of water temperature on polychlorpinene concentration is presented. The effectiveness of polychlorpinene is determined not only by temperature but also by the composition of the fish fauna, the area of aquatic vegetation, degree of development of zoo- and phytoplankton, as well as by the mineralization of the water, the amount of dissolved gases, pH, degree of humification, character of bottom deposits, etc. With an increase in the area occupied by aquatic vegetation, with a rise in pH and a change of the type of water mass from oligotrophic to dystrophic, mesotrophic and eutrophic, the polychlorpinene concentration must be increased by 0.01-0.02 mg/l for each 10% of aquatic vegetation area (of the total lake area), for each unit increase in pH, and so on. (Auth.)

8917. Domurat, Jerzy (Dept. Fish Physiol., Coll. Agr. Olsztyn, Poland). 1964. EMBRYONIC DEVELOPMENT OF THE RAINBOW TROUT, Salmo irideus Gibb. AND THE BROWN TROUT, Salmo trutta L., IN A NON-AQUEOUS MEDIUM. Zool Pol 14(3/4): 125-151. Illus. (Pol. and Russ. summ.); Biological Abstracts, 47(18): Abst. No. 88104. 1966.

Embryos of both trout spp. were kept in paraffin oil from the beginning of segmentation till the closure of blastopore. Control groups were kept in water. No difference in the development of either experimental spp. was ascertained until the blastula stage in S. irideus and that of a young morula in S. trutta. Retardation of the development occurs as well as a high mortality rate of the embryos in the stages more advanced than blastula and morula respectively. The differences in development of the experimental and control material was less conspicuous at a lower temperature. The period in which development is inhibited or death takes place, seems to be connected with critical stages of the embryo. Increase of mortality is associated with deformation of the embryo. No changes in the histological picture were found after retardation of development. The disturbances induced by the non-aqueous medium seem to be connected with the difficulty of gas exchange. --Courtesy NSF (PL 83-480) 1965.

8918. Protasov, V.R., E.V. Romanenko, and Yu. D. Podlipalin. 1965. THE BIOLOGICAL SIGNIFICANCE OF SOUNDS PRODUCED BY SOME FISHES. Vop Ikhtiol 5(3): 532-539. Illus.; Biological Abstracts, 47(18): Abst. No. 90578. 1966.

Sounds produced by the pike perch Lucioperca lucioperca, the ninespined stickleback Pungitius pungitius, the Sakhalin bullhead Cottus amblystomopsis, the haddock Gaddus aeglefinus and the Japanese ruff Sebastodes schlegekli were recorded in 1962 (signal patterns and frequency amplitude characteristics illustrated). Such sounds accompanied aggressive-defensive reactions during spawning activities, offspring protection and rivalry between males. While representing various systematic and ecologic groups, the named species exhibited a common trait of spawning behavior (i.e. pairing and offspring protection) relating to occupation and protection of a defined territory. Pinging sounds were emitted by all of the named species except the bullhead and low frequencies predominated. A sudden emission of such sounds repelled various other fishes: they are attributed to an intraspecific and an interspecific communication function. --B. Le Bental.

8919. Autko, B.F. 1964. COMMERCIAL AND BIOLOGICAL CHARACTERIZATION OF PIKE IN THE KUIBYSHEV RESERVOIR ON THE BASIS OF 1960-63 DATA. Tr Tatarskogo Otd Gos Nauch-Issled Inst Ozern Rechn Rybn Khoz 10. 249-259. From: Ref Zh Biol, 1965, No. 11I60. (Translation); Biological Abstracts, 47(19): Abst. No. 90685. 1966.

The decrease in the pike stock of the Kuibyshev Reservoir has been caused by unfavorable conditions for the natural propagation of the fish (change in water level during reproduction, reduction of spawning area). The effect of the fishery was less marked because it removed not more than 36% of female first-time spawners. Age, sex and size composition of the pike catches were investigated in 1959-63. Fish aged 2-9 years occurred in the catches, with a predominance of individuals of the 1956 and 1957 year-classes (1st generations after the construction of the reservoir). Annual increments ranged from 4.4 cm in fish of the oldest age groups to 11 cm in fish of the youngest age groups. In recent years a reduction in growth rate has been observed in fishes of all age groups, the length of 3-year-olds having decreased by 9 cm between 1959 and 1963. A difference in growth rate, increasing with age, has been noted in males and females. The growth rate of males was slow. Among older age groups females were preponderant. (Auth.)

8920. Keller, Myrl (Ohio Div. Wildlife, Sandusky, Ohio). 1965. THE WINTER FISHERY OF SOUTH BASS ISLAND WITH A CENSUS OF THE 1963 CATCH. Ohio Jour. of Science 65(6): 327-334. Illus. Map; Biological Abstracts, 47(19): Abst. No. 90709. 1966.

The winter hook and line fishery of the South Bass Island Area in western Lake Erie has contributed phenomenal catches to the angler over the years. This

fishery which operates on a sport and commercial basis has had a history of continual changes in species composition of the catch. Early records indicate that herring, Coregonus artedii (Le Seuer), saugers, Stizostedion canadense (Smith), burbot, Lota lota (Linnaeus), and walleye, Stizostedion vitreum vitreum (Mitchill), dominated the catches. During the more recent years yellow perch, Perca flavescens (Mitchill), and American smelt, Osmerus mordax (Mitchill), have dominated the catches. A creel census of the catch was made during the winter of 1963 to compare the past and present fishes. Estimates of the 1963 catch when compared to previous years were high. The total catch in 1963 was estimated to be 90,280 lb. or 285,280 fish. Of this total, 97.3% were yellow perch. American smelt, white bass, Roccus chrysops, and walleye each made up less than 1% of the catch. (Auth.)

8921. Lyakhnovich, V. P., I. T. Astapovich, R. M. Surinovich, L. V. Prosyanik, and L. A. Korobchenko. 1964. RESULTS OF LARGE-SCALE OBSERVATIONS ON POND FERTILIZATION. In: Biological basis of fisheries in the inland waters of the Baltic region. Nauk. tekh.: Minsk. 93-103. From: Ref Zh Biol, 1965, No. 11I80. (Translation); Biological Abstracts, 47(19): Abst. No. 90716. 1966.

Growing and feeding ponds were fertilized with superphosphate, ammonium nitrate, and manure. Best results were obtained with organo-mineral fertilizers as well as with an NH_4-NO_3-superphosphate ratio of 2:1. Fertilization raised primary production, zooplankton biomass and fish production. Benthos biomass was not increased. Natural fish production increased 2- to 3-fold. It is noted that pond fertilization is more profitable than artificial feeding of fish. (Authors)

8922. Vinnikov, Ya. A., V. I. Govardovskii, and I. V. Osipova (I. M. Sechenov Inst. Evolut. Physiol. Biochem., Leningrad, USSR.). 1965. ELECTRON-MICROSCOPICAL STUDY OF THE ORGAN OF GRAVITATION, THE UTRICULUS, OF THE PIKE (Esox lucius). Biofizika 10(6): 1003-1006. Illus.; Biological Abstracts, 47(19): Abst. No. 92079. 1966.

The organ of gravitation—the utriculus—of the pike (Esox lucius) contains a single type of receptor cells of a cylindrical form, previously described in terrestrial vertebrates as cells of the second type. The apical surface of the cells is supplied with 8-15 immobile stereocilia-hairs with a single polar location of the kinocilia which have the structure characteristic of all mobile flagellae. Fine "button-like" light and dark nerve endings are adjacent to the basal part of the hair cells. The nerve endings, penetrating into the receptor layer of the utriculus, can contain a myelin sheath for a great distance. The peculiarities of the substructure of the organization of the utriculus of the pike are characterized by retention of a series of primitive features which are characteristic of the lateral line organs. These features can be explained both in connection with the ecological conditions of living in an aqueous medium, and in connection with the character of movement of these animals in the gravitational field, and also by the phylogenetical development of the labyrinth from the lateral line organs. --D. Franklin

8923. Meshkov, M. M. 1965. SOME PATTERNS OF THE TRANSITION FROM THE EMBRYONIC TO THE LARVAL STAGE. In: The theoretical foundations of fish raising. Nauka: Moscow. 165-167. From: Ref Zh Biol, 1966, No. 2M89. (Translation); Biological Abstracts, 47(19): Abst. No. 93034. 1966.

A number of critical periods are noted in the transition from the embryonic to the larval stage. During the period of the preparation for hatching, the embryo is most sensitive to external action (changes in the environmental temperature, content of O_2 and CO_2). The hatching time may be shifted depending on environmental conditions: the basic factor is the temperature and less influence is exerted by the content of gases in the water, the pH, mechanical action, and the amount of light. Premature hatching leads to the death of the larvae. The considerable plasticity of the late embryo and early larvae is considered by the author to be an adaptive characteristic consisting in accelerated development of the vitally important organs, especially the vascular system which affords intensive metabolism. The weaker the development of the larva, the faster the rate of its develop-

ment. Hatching should be considered a developmental jump whose duration depends on the adaptation of the species and on the actual developmental conditions.

8924. Magnin, Etienne, and Gerard Beaulieu (Centre Biol., Quebec, Quebec, Canada). 1965. VARIOUS ASPECTS OF THE BIOLOGY AND ECOLOGY OF THE CATFISH Ictalurus punctatus (Raf.) IN THE SAINT LAURENT RIVER DERIVED FROM DATA OBTAINED BY MANKING. Natur Can 92(12): 277-291. Illus.; Biological Abstracts, 47(19): Abst. No. 95050. 1966.

Studies on the catfish conducted between 1947-1957 have established an estimation of growth rate which varies with age. This warm water fish is distributed extensively and capture permitted studies of its biological characteristics and their movements during the colder season. --G. Hanson.

8925. Ruf, M. (Tierarztl. Fak., Munich, West Germany). 1965. RADIOACTIVITY IN FRESH-WATER FISH. Zentralbl Veterinarmed Reihe B 12(7): 605-612. Illus. (Engl., French, and Spanish summ.); Biological Abstracts, 47(20): Abst. No. 95613. 1966.

The increase in contamination of surface water with artifically produced radioactive materials makes it important to assess the degree of contamination of our indigenous fish in so far as they may be a source of radionuclides when eaten by man. The article deals with the magnitude of the processes of incorporation, particularly of radioactive strontium and cesium into fresh-water fish in Bavaria. Measurements show, radiostrontium is mainly deposited in the hard tissues and radiocesium in both soft and hard tissues. The degree of incorporation depends on a number of factors which cannot be precisely predicted. In addition to absorption with the food, absorption of radioactive strontium through the body surface seems to play an important role in fish. (Auth.)

8926. Cottam, Clarence (Rob and Bessie Welder Wildlife Foundation, Sinton, Texas). 1965. THE ECOLOGISTS' ROLE IN PROBLEMS OF PESTICIDE POLLUTION. BioScience 15(7): 457-463; Biological Abstracts, 47(20): Abst. No. 95693. 1966.

Application of ecological principles is urgently needed in applying pesticides because of the direct, indirect, and possible long-time effects these may have upon man, his resources, and his environment. Many examples are given showing some of these effects upon fisheries and wildlife and upon reproduction and survival. (Auth.)

8927. Hickling, C. F. (59 Greenway, London, England). 1966. ON THE FEEDING PROCESS IN THE WHITE AMUR, Ctenopharyngodon idella. J. Zool. Proc. Zool. Soc. London, 148(4): Illus.; Biological Abstracts, 47(20): Abst. No. 95806. 1966.

The white amur or grass carp, Ctenopharyngodon idella Val. is almost exclusively herbivorous, feeding chiefly on macrophyte material. The pharyngeal teeth are described, and their effect on the ingested food material. The distribution of the digestive enzymes along the gut suggests that most amylase and protease is in the mid-gut, and lipase in the anterior gut. The gut is short for a herbivore, and food passes through in less than 8 hours at 28° to 30° C. Digestion is incomplete, and about half the food material is passes out as feces which can support, directly or indirectly, a large biomass of other species of fish. (Auth.)

8928. Hochachka, P. W. (Ramsay-Wright Zool. Lab., Univ. of Toronto, Toronto, Ontario, Canada). 1966. LACTATE DEHYDROGENASES IN POIKILOTHERMS: DEFINITION OF A COMPLEX ISOZYME SYSTEM. Comp. Biochem. Physiol, 18(2): 261-269. Illus.; Biological Abstracts, 47(20): Abst. No. 96087. 1966.

Five kinds of subunits (A-E) are involved in generating 14 isozymes of lactic dehydrogenase (LDH) in skeletal muscle of Salvelinus namaycush and S. fontinalis. One group of 5 LDH, migrating near the origin at neutral pH, is derived from random assembly of D and E subunits into tetramers. Another essentially independent series of 9 LDH, migrating anodally at neutral pH, are

formed by a non-random assembly of subunits A, B and C to yield A_4, A_3B_1, A_2B_2, A_1B_3, B_4, B_3C_1, B_2C_2, B_1C_3, and C_4. Liver of lake trout contains 5 LDHs homologous to the A-B series in muscle, but only the homopolymer B_4 is abundant. Brook trout liver has the B-C series with only C_4 in abundance. Liver of Salmo gairdneri has only the A_4 homologue. The LDHs formed in dissociation-reassociation tests and in interspecies crosses are consistent with the 5-subunit model advanced. (Auth.)

8929. Hoffert, J. Russell, and P. O. Fromm (Mich. State Univ., Dept. Physiol., East Lansing, Mich.). 1966. EFFECT OF CARBONIC ANHYDRASE INHIBITION ON AQUEOUS HUMOR AND BLOOD BICARBONATE ION IN THE TELEOST (Salvelinus namaycush). Comp. Biochem. Physiol., 18(2): 333-340. Illus.; Biological Abstracts, 47(20): Abst. No. 96137. 1966.

The blood-aqueous humor barrier in the eyes of the fresh-water teleost S. namaycush was investigated. The bicarbonate level in the aqueous humor does not appear to be in simple equilibrium with that in the plasma. Administration of Diamox, a carbonic anhydrase inhibitor, resulted in a significant lowering of the aqueous bicarbonate level which was incompletely compensated for by an increase in the chloride concentration of the aqueous. Diamox has no significant effect on hematocrit, hemoglobin or O-carrying capacity of lake trout blood. The role of carbonic anhydrase in aqueous humor formation is discussed. (Authors)

8930. Luk'yanenko, V. I. (Freshwater Animal Physiol. Lab., Borok, USSR). 1965. A GENERAL CHARACTERIZATION AND THE PHASE PATTERN OF THE COURSE OF PHENOLIC POISONING OF CARPS IN THE LIGHT OF THE STRESS THEORY. Vop Ikhtiol 5(3): 540-547. Illus.; Biological Abstracts, 47(20): Abst. No. 97425. 1966.

A group of 400 carps (Carassius carassius L., mainly 2-3 years old or fry) were exposed to phenol concentrations of 5 to 800 mg/l (up to 240 hr., water temperature 13 to 15°C, pH 7.3 to 7.5, hardness 9.2 to 10.6 H° German scale, O_2=5 to 6.5 mg/l) in a study of patterns of phenolic intoxication. Behavior in the toxic solution, dynamics of the intoxication process and death served as basic indicators of the toxicity level for a given concentration. There is a description of clinical symptoms and 3 basic stages (pronounced locomotive excitability; loss of balance reflex, side heeling, impulsive jerky motion in lateral position; convulsive spasm in lateral position, total loss of locomotion) of phenolic intoxication. A tri-phase pattern develops only at 25 mg/l or greater concentrations, and is related to Selye's stress theory. Changes in the level of resistance to phenolic poisoning are determined by charting mortality percentiles against exposure period and concentration. Selye's 3 stages of the general adaptive syndrome correlate with the tri-phase intoxication pattern. Analysis of experimental data in terms of the stress theory makes it possible to relate studies in fish toxicology to the general trend of research on an organism's adaptive reactions. --B. Le Bental.

8931. Prazdnikov, E. V. (Murmansk Mar. Biol. Inst., S. M. Kirov Kola Branch, Acad. Sci. USSR, Murmansk, USSR). 1965. REACTIVITY OF THE CELLULAR ELEMENTS OF THE BLOOD OF HUMPBACK SALMON EMBRYOS. Dokl Akad Nauk SSSR 165(1): 207-209. Illus.; Biological Abstracts, 47(20): Abst. No. 97764. 1966.

The leucocytic elements of the blood of humpback salmon embryos, particularly monocytes, lymphocytes and, in part, the polymorphonuclear leucocytes, are able to phagocytose granules of carmine and Bacillus subtilis, particularly when the foreign particles penetrate the blood stream. However, when tissue is injured in the focus of inflammation, leucocytic elements are accumulated only in the course of 3, and sometimes of 7 days after injury, and do not display much phagocytic activity. They participate chiefly in the lysis of the injured tissues. The leucocytic infiltration of the tissues of the focus of injury in humpback salmon embryos is weakly expressed and appears on the 7-15th day. --D. Franklin.

8932. Molnar, K., and I. Berczi (Veterinarmed. Forschungsinst. Ungar. Akad. Wiss., Budapest, Hungary). 1965. DEMONSTRATION OF PARASITE-SPECIFIC ANTIBODIES IN FISH BLOOD BY AGAR-GEL-DIFFUSION PRECIPITATION TEST. Z Immunitats Allergie-Forsch 129(3): 263-267. (Engl., French, Spanish, and Russ. summ.); Biological Abstracts, 47(20): Abst. No. 98210. 1966.

Sera from Abramis brama fishes infected with Ligula intestinalis, or Digramma interrupta as well as normal fish sera were examined by agar gel diffusion precipitation test. As an antigen saline extracts of the parasites were used. The results indicate that Abramis brama fishes are capable of developing specific antibodies against ligula-infestation. (Authors)

8933. Edwards, R. W., H. Egan, M. A. Learner, and P. J. Maris (Water Pollut. Res. Lab., Div. Sci. and Ind. Res., Stevenage, England). 1964. THE CONTROL OF CHIRONOMID LARVAE IN PONDS, USING TDE (DDD). J. Appl. Ecol. 1(1): 97-117. Illus.; Biological Abstracts, 48(2): Abst. No. 9796. 1967.

Initial laboratory tests suggested that settleable powder dormulations of TDE (tetrachloro-diphenyl-ethane) and DDT at application rates greater than 0.5 lb/acre (0.56 kg/ha) would be effective in controlling Chironomus larvae and that, while trout would not be killed either directly (0.5-1 lb/acre) or by feeding on TDE-treated larvae, other invertebrates, e.g., Asellus, would be affected. Tubificids were not killed at application rates up to 2 lb/acre. TDE was considered a more useful insecticide than DDT because of its lower toxicity to fish. TDE (1 lb/acre) was applied to a pond in January 1962 after a period of field observations. A comparison between the treated pond and a neighboring control pond using emergence cage, plankton sweep and mud core data showed that mud-dwelling chironomid larvae were greatly reduced in species and numbers, and that culicids and ephemeropterans were also killed. There was no discernible effect on other benthic or planktonic organisms. Carp were kept in cages for 11 months following the insecticide treatment; 35% died but the survivors grew well. By November 1962 fish tissues contained about 15 ppm TDE. After spraying, TDE concentrations in the water fell from 0.033 to 0.001 ppm (analytical limits of sensitivity) in 2 weeks, and in the mud from 1 to 0.12 lb/acre in about 10 months.

8934. Nikolaeva, V. M. (Inst. Biol. S. Seas., Acad. Sci. Ukr. SSR, Sevastopol', USSR). 1965. DEVELOPMENTAL CYCLE OF DIDYMOZOIDAE TREMATODES. Zool Zh 44(9): 1317-1327. Illus. (Engl. summ.); Biological Abstracts, 47(20): Abst. No. 99303. 1966.

New metacercaria found in fishes (Sardinops ocellata, Zeus faber and others) of the Atlantic Ocean are described. The scheme of the developmental cycle of the trematodes of the family Didymozoidae is presented as follows: 1st alternate hosts are Gastropod molluscs, 2nd alternate hosts are Crustaceans; 3td alternate hosts and reservoir hosts are small fishes. Final hosts are large predatory fishes (Thynnus, Pelamys sarda, Mola mola and others). (Auth.)

8935. Gould, William R. (Zool. Dept., Montana State Univ., Bozeman, Mont.). 1966. CUTTHROAT TROUT (Salmo clarkii Richardson) X GOLDEN TROUT (Salmo aquabonita Jordan) HYBRIDS. Copeia 3. 599-600.; Biological Abstracts, 47(20): Abst. No. 99785. 1966.

A new artificially produced hybrid is reported with color, meristic, and morphometric data.

8936. Korovina, V. M., A. I. Lyubitskaya, and E. A. Dorofeeva (Zool. Inst. Acad. Sci. USSR, Leningrad, USSR). 1965. THE EFFECT OF VISIBLE LIGHT AND DARKNESS ON RATE OF FORMATION OF SKELETAL CARTILAGE ELEMENTS IN TELEOST FISHES. Vop Ikhtiol 5(3): 403-410; Biological Abstracts, 47(20): Abst. No. 99790. 1966.

Eggs of spp. developing in natural environments under varying illumination (i.e. the fall-spawning Salmo salar L. or S. trutta L., the spring-spawning Esox lucius L. and the intraspecific hybrid Cyprinus carpio L. X C. carpio haematopterus Temm. et Schl.) were incubated in darkness or under illumination. The

degree of that illumination exerted significant effects on the development of skeletal cartilage. The pattern of such effects is wholly dependent on the ecology of the species concerned. An approximation of natural lighting environments yields the optimal conditions for growth of skeletal cartilage. --B. LeBental

8937. Sathyanesan, A.G., and Walter Chavin (Dept. of Zool., Banaras Hindu Univ., Varanasi, Uttar Pradesh, India). 1966. EFFECTS OF WHOLE-BODY IRRADIATION ON THE ADRENAL OF THE GOLDFISH Carassius auratus L. Radiat. Res., 28(2): 352-364. Illus.; Biological Abstracts, 47(21): Abst. No. 100532. 1966.

Whole-body-irradiated (Ce^{137}) goldfish (Carassius auratus L.) showed little mortality after 1 to 2 kr for the experimental period of 90 days. The LD_{50} at 2.5 kr occurred at 15 days; 38% survived for 30 days, and 8% for 90 days. With 10 kr, the LD_{100} was achieved at 17 days. Significant adrenal alterations were present 4 days post irradiation at all dose levels. The sequence of changes occurring with time at the 2.5-kr dose level included hypertrophy, hyperplasia, atrophy, degeneration, and cyst formation. Adrenocortical phospholipid granulation was reduced after irradiation. A numerical increase in medullary cells also occurred. Blood vessel alterations ranged from dilation and rupture to occlusion. In some cases, adrenal cells appeared in the limina of the blood vessels after rupture. In other cases, microhemorrhage and edema were present. The adrenal alterations in response to irradiation were generally comparable to those described in similarly treated mammals. (Authors)

8938. Magnuson, John J., and John H. Prescott (Bur. Commercial Fisheries Biological Lab., Honolulu, Hawaii). 1966. COURTSHIP, LOCOMOTION, FEEDING, AND MISCELLANEOUS BEHAVIOUR OF PACIFIC BONITO (Sarda chiliensis). Animal Behavior, 14(1): 54-67. Illus.; Biological Abstracts, 47(21): Abst. No. 100586. 1966.

In a 2-million liter salt water tank at Marineland of the Pacific, California, Sarda chiliensis, 57 cm. in fork length, swam continuously at 88.2 cm/sec. during the day when not feeding or courting. Speed of feeding fish (body lengths/sec.) equaled 0.4905 plus 0.6394 times the tail beats/sec. A transient vertically barred pattern of coloration occurred on the flanks of feeding fish. Courtship included temporary pairing, aggressive defense of a female, and a sequence leading to simultaneous and adjacent release of gametes. A sexual dimorphism in behavior released pair formation. Threat among males included an intense vertically barred coloration similar to the transient pattern of feeding bonito. Mouth closures, yawns, snaps, leans, and bends were described, and functions associated with olfaction, gill ventilation, drinking, schooling, and food passage were considered. (Authors)

8939. Petrenko, L.A. 1964. COMPARATIVE CHARACTERISTICS OF HATCHERY AND RIVER SALMON SMOLTS. Izv Gos Nauch-Issled Inst Ozern Rechn Rybn Khoz 57. 271-276. From: Ref Zh Biol, 1965, No. 13I111. (Translation); Biological Abstracts, 47(21): Abst. No. 100719. 1966.

The smolts were captured in the Luven'ga River in 1960 by means of seines; in 1961-62 they were taken from the nets of counting fences. The downstream migration of the smolts started during the fall of the peak flood, at a water temperature of up to 8-9° C. A study of the age composition of the smolts showed that hatchery and river smolts started to descend to the sea at age 2. Young of older age groups predominated at the start of the downstream migration. The average weight of the smolts was higher at the start of the downstream migration than at the end. The growth rate of hatchery smolts did not lag behind that of river smolts. (Auth.)

8940. Conte, F.P., H.H. Wagner, J. Fessler, and C. Gnose (Radiat. Center, Oregon State Univ., Corvallis, Oreg.). 1966. DEVELOPMENT OF OSMOTIC AND IONIC REGULATION IN JUVENILE COHO SALMON Oncorhynchus kisutch (Pisces). Comp. Biochem. Physiol., 18(1): 1-15. Illus.; Biological Abstracts, 47(21): Abst. No. 101658. 1966.

The development pattern for the osmotic and ionic regulatory system during the juvenile phase of the life cycle was determined. Measurements of survival time were made monthly as were changes in blood osmotic, sodium and chloride concentrations following exposure to sea water (salinity = 30 °/oo). Development of sea-water adaptation preceded seaward migration and parr-smolt transformation by 6-7 months. No regression of adaptation was observed following the terminal stages of the migration period. Sea-water survival for various salinities (20 °/oo → 30 °/oo) was shown to be a function of size and not chronological age. Relative survival times between certain species of the genus Salmo were compared to Oncorhynchus kisutch. Variability of the osmotic and ionic regulatory system was indicated by the deviation between blood concentrations (i.e., mOsm/l, mEquiv. Na^+/l and mEquiv. Cl^-/l) of fresh-water fish (control) and fish exposed to sea water during the pre-migratory, migratory and post-migratory periods. (Authors)

8941. Wellings, S.R., R.G. Chuinard, and M. Bens (Univ. of Oregon Med. Sch., Portland, Oreg.). 1965. A COMPARATIVE STUDY OF SKIN NEOPLASMS IN FOUR SPECIES OF PLEURONECTID FISHES. In: Symposium on viral diseases of poikilothermic vertebrates, Kearneysville, West Virginia, 23-26 September, 1964. Annals New York Academy of Science, 126(1): 479-501.; Biological Abstracts, 47(21): Abst. No. 102848. 1966.

Fish of the family Pleuronectidae were collected in the waters of the San Juan Islands, Washington, during 1962-64. Epidermal papillomas were observed in 3 species: English sole (Parophrys vetulus), rex sole (Glyptocephalus zachirus), and the flathead sole (Hippoglossoides elassodon). The papillomas were most frequent (6.4%) in the flathead sole and appeared to arise during the first year of life from 1 to 2 mm skin lesions, designated angioepithelial nodules because of their histological structure. In addition, skin lesions descriptively named angioepithelial polpys were observed on sand sole (Psettichthys melanostictus). Cytoplasmic virus-like particles were identified in electron micrographs of epidermal papillomas of flathead sole. (Authors)

8942. Brown, C.J.D. (Montana State Univ., Bozeman, Mont.). 1966. NATURAL HYBRIDS OF Salmo trutta X Salvelinus fontinalis. Copeia 3. 600-601; Biological Abstracts, 47(21): Abst. No. 104991. 1966.

Hybrid trout were secured in Montana streams by fishermen. These varied in total length from 182-211 mm. Some characters were more like brown trout, some like brook trout and others intermediate. Their coloration was typical of "tiger" trout described by previous workers.

8943. Reed, Edward B., and George Bear (Zool. Dept., Colorado State Univ., Ft. Collins, Colo.). 1966. BENTHIC ANIMALS AND FOODS EATEN BY BROOK TROUT IN ARCHULETA CREEK, COLORADO. Hydrobiologia 27(1/2): 227-237; Biological Abstracts, 47(22): Abst. No. 105674. 1966.

About 100 brook trout (Salvelinus fontinalis) were caught by flyfishing and their stomach contents analyzed. The benthic animals in the creek were sampled at the same time. About 3/4 of the stomach contained terrestrial insects. These made up nearly half of the stomach contents. Thus nearly 1/2 of the support for the trout came from outside the aquatic ecosystem. --K. E. Marshall.

8944. Banner, Albert H., Philip Helfrich, and Twesukdi Biyakarnchana (Inst. Mar. Biol., Univ. of Hawaii, Honolulu, Hawaii). 1966. RETENTION OF CIGUATERA TOXIN BY THE RED SNAPPER, Lutjanus bohar. Copeia 1966(2): 297-301; Biological Abstracts, 47(22): Abst. No. 105677. 1966.

A sample of 66 specimens of the red snapper, Lutjanus bohar, from Christmas Island, Line Islands, whose initial level of toxicity was approximated statistically, was maintained in the holding ponds at the Hawaii Marine Laboratory, Honolulu, for varying periods from 3 to 30 months on a nontoxic diet. At the end of the period the fish showed no significant decline in their toxicity. (Authors)

8945. Rabinowitz, Joseph L., and Ralph M. Myerson (Veterans Admin. Hosp., Philadelphia, Penna.). 1966. EXPOSURE OF TROPICAL FISH TO DIMETHYL SULFOXIDE (DMSO) WITH SPECIAL REFERENCE TO TOXICITY AND EFFECTS ON THE UPTAKE OF RADIOACTIVE DYES. Proc. Soc. Exp. Biol. Med., 121(4): 1065-1067; Biological Abstracts, 47(22): Abst. No. 107230. 1966.

The LD_{50} concentration of DMSO (dimethysulfoxide) was 1.9% in the case of glow tetras, neon tetras, guppies, mollies and tetras. Angel fish, zebras and catfish appear to tolerate higher concentrations of DMSO. In addition to the species differences, a striking increase in sensitivity to DMSO was noted in males. In almost every instance, all male fish died before the first female succumbed. The variation in uptake of radioactively labeled dyes by fish was very great. Different batches of fish show differences in their effect to DMSO. (Authors)

8946. Nadkarni, V.B., and Aubrey Gorbman (Dept. of Zoology, Univ. of Washington, Seattle, Wash.). 1966. STRUCTURE OF THE CORPUSCLE OF STANNIUS IN NORMAL AND RADIOTHYROIDECTOMIZED CHINOOK FINGERLINGS AND SPAWNING PACIFIC SALMON. Acta Zool (Stockholm) 47(1-8): 61-66; Biological Abstracts, 47(22): Abst. No. 106053. 1966.

The histological structure of the corpuscle of Stannius of normal and radiothyroidectomized chinook fingerlings, and 2 species of spawning Pacific salmon is described. The majority of the cells of the corpuscle are PAS-(periodic acid-schiff)-positive and also AF (acid fast)- positive, but a few are PAS-negative and AF-negative. There is no change in the histological picture of the corpuscle after radiothyroidectomy. Some of the spawning salmon exhibited central degeneration of the corpuscle. (Authors)

8947. Yarzhombek, A.A., and L.G. Grachev. 1964. EFFECT OF CERTAIN SUBSTANCES ON THE DEVELOPMENT OF COHO EGGS. Tr Molodykh Uch Vses Nauch-Issled Inst Morskogo Rybn Khoz Okeanogr 51-53.; From: Ref Zh Biol., 1965, No. 13I70. (Translation); Biological Abstracts, 47(22): Abst. No. 108153. 1966.

The effect of 10 substances on coho eggs in the active embryonic stage was investigated at 4° C. The toxicity of a substance was expressed mathematically by the relationship between the concentration of the dissolved substance and the time of onset of egg mortality. The relationship is hyperbolic. The maximum permissible concentration of a toxic substance in water (Ko) was determined by the formula $A=(K - K_o)^n(T-T_o)$, where T_o and T are, respectively, the minimal and actual times of onset of mortality, K is the concentration of the dissolved substance, and A and n are proportionality constants. The toxic effect of sugar, alcohol, tannin, urea, and NaCl was found to be low, that of acetic and salicylic acids intermediate, and that of KOH, H_2SO_4 and ammonia low. Ammonia and urea destroyed egg membranes. Tannin at a concentration of 1-1.5% caused shrinkage of the egg membrane in 2-3 hours. Concentrations of saccharose higher than 12% irreversibly deformed live eggs.

8948. De Azevedo, Pedro, Eduardo Millen, Geraldo Jose R. Alckmin, and Helio L. Stempniewski. 1964. ARTIFICIAL FEEDING OF Cyprinus carpio. THE USE OF PENICILLIN MYCELIUM AS A RATION SUPPLEMENT. Bol Ind Anim 22. 69-79. Illus. (English summ.); Biological Abstracts, 47(22): Abst. No. 108198. 1966.

The development of fish culture in ponds, represents a valuable aid for animal protein production at low cost for Brazilians. Penicillin mycelium meal introduced in swine and poultry rations, accelerated the growth of the animals. According to this idea, a first experiment with Cyprinus carpio was made in fertilized ponds, part developing in winter time with no separation of sexes. The comparison of treated lots with the controls through statistical analysis showed the significant effect of the treatments when the tests of F, and of Tukey were applied to the ponderal results after 6 and 7 months. The significance was higher at the end of the 6th month, as compared to the same one at the end of the 7th. The assay was made from the technical and economic points of view. A 2% dose

of penicillin mycelium meal, as supplement to basic rations for C. carpio, in fertilized ponds was recommended. (From authors summ.)

8949. Nyman, L. (Dept. Genetics, Uppsala, Sweden). 1965. PROTEIN VARIATIONS IN ATLANTIC SALMON (Salmo salar). Lantbrukshogskolans Ann 31(2): 225-230. Illus.; Biological Abstracts, 47(22): Abst. No. 109991. 1966.

A number of organs and blood serum of Atlantic salmon were tested with starch gel electrophoresis. The adult fish of the Indal River were very homogeneous but were different from a Canadian male salmon of the same species in the serum protein pattern. Young fish from different Swedish rivers showed complicated variations in organs and serum, thereby indicating an ontogenetic development. (Auth.)

8950. Turnage, Don. (Berwick High School, Berwick, Louisiana). 1964. A SURVEY OF FISHES IN LAKE PALOURDE, LOUISIANA. Proc. Louisiana Acad Sci., 27. 8-11; Biological Abstracts, 47(22): Abst. No. 109997. 1966.

Over 1500 specimens representing 19 families, 28 genera, and 33 species were collected. Seventeen were euryhaline forms of which 12 have not been collected farther inland and 16 are freshwater forms which have been previously reported in the state. This is drawn as a result of this work: approximately one-half of the population of this shallow, freshwater eutrophic lake near the Gulf of Mexico is made up of freshwater forms while euryhaline and marine forms constitute the other half. Many forms reside in an area like this on a temporary or spawning basis. An area such as this is the fringe zone of freshwater forms as well as marine and brackish forms as indicated by the presence of such large numbers of families and genera with but a few representative species in each. (Auth.)

8951. Levan, Albert, Warren W. Nichols, Michael Peluse, and Lewis L. Coriell (Inst. Genetics, Univ. Lund, Lund, Sweden). 1966. THE STEMLINE CHROMOSOMES OF THREE CELL LINES REPRESENTING DIFFERENT VERTEBRATE CLASSES (rat-kangoroo, Potorous tridactylis, fathead minnow, Pimephales promelas, bull frog, Rana catesbeiana). Chromosoma 18(2): 343-358. Illus.; Biological Abstracts, 47(23): Abst. No. 110299. 1966.

The chromosomes of the stemlines were analyzed in 3 cell lines stored in the Cell Bank of the South Jersey Medical Research Foundation, Camden, N. J. The cell lines were of marsupial, amphibian and teleostean origin, and 10 to 25 complete chromosome analyses in each of them formed the basis for idiograms. In the marsupial and the frog, comparison could be made with the normal karyotype of the species. (Authors)

8952. Sreenivasan, A. (Freshwater Biol. Sta., Bhavanisagar, Madras, India). 1966. LIMNOLOGY OF TROPICAL IMPOUNDMENTS. I. HYDROLOGICAL FEATURES AND FISH PRODUCTION IN STANLEY RESERVOIR, METTUR DAM. Int. Rev. Gesamten Hydrobiol., 51(2): 295-306; Biological Abstracts, 47(23): Abst. No. 110577. 1966.

At full level, Stanley Reservoir occupies an area of 9,276 ha and has a volume of 2,646 x 10^6 m^3. It is formed by a dam across the River Cauvery at Mettur in Madras. Thermal conditions, O_2, pH, nutrients, bottom soils, primary production and fish production are described. Temperature is uniformly high. Stratification seldom occurs, mainly because of water removal through a low-level "intake" (outlet). Primary production and fish production are low, the latter amounting to only about 0.1% of primary production. --C. C. Davis.

8953. Malyutin, V. S., and V. A. Mityushkin. 1964. THE OB' INCONNU Stenodus leucichthys nelma (Pallas) AS AN OBJECT FOR ACCLIMATIZATION IN THE AMUR RIVER AND ESTUARY. In: Conservation of nature in the Far East. Vladivostok 2. 143-147. From: Ref Zh Biol, 1965, No. 15I109. (Translation); Biological Abstracts, 47(23): Abst. No. 110591. 1966.

This paper considers the life history of the Ob' inconnu and the prospects of

its acclimatization in the Amur. The potential enemies and rivals of the inconnu are discussed. A generally favorable prognosis is given for the acclimatization of the fish. Its introduction into the Amur in the form of eggs and juveniles is recommended.

8954. Takamatsu, Chiaki, Tokiro Hashimoto, Tetsusaburo Nishikawa, Takao Suzuki, and Yoshikazu Sahashi (Nippon Formula Feed Manufacturing Co., Ltd., Yokohama, Japan). 1965. GROWTH STIMULATING ACTIVITIES OF VITAMIN-DEPENDENT ENZYMES IN FRESH LIVER FOR RAINBOW TROUT FINGERLINGS. J. Vitaminol., 11(4): 275-280. Illus.; Biological Abstracts, 47(23): Abst. No. 111011. 1966.

Concerning the growth-stimulating effect of fresh beef liver on rainbow trout fingerlings, the metabolism of ingested amino acids in the liver was studied and successively the occurrence of vitamin A-protein-complex in the liver was tested by electrophoresis, but no positive results were obtained. Halver's evaluation of fresh liver as a high vitamin diet was not confirmed. The enzymatic fractionation using sucrose was tested and the fraction soluble in 45% sucrose was found most effective as the growth-promoting factor for rainbow trout fingerlings. Repeated investigations showed that the active principle of fresh liver for the fish fingerlings might be chiefly due to various vitamin-dependent enzyme systems. (From auth. summ.)

8955. Manteifel, B.P., and V.R. Protasov. 1964. EFFECT OF LIGHT INTENSITY ON THE BEHAVIOR OF FISH. In: Techniques for the investigation of fish physiology, Israel Program for Scientific Translations: Jerusalem. 271-277. Illus.; Biological Abstracts, 47(24): Abst. No. 115581. 1966.

Changes in light intensity markedly affect the behavior of fish, mainly their motor and alimentary activities, their capacity to obtain food, their defense reactions, etc. Since it has a strong effect on the behavior of fish and of the organisms which serve as food for the former, light is one of the important factors determining the nature of the relationship between the fish and its prey, the food availability, switching from one food to another, daily and seasonal vertical migrations of plankton and of fish, etc. All biotic interrelationships in the upper 200m sea layer are determined by light conditions. The effect of light intensity on the behavior of fish has been only little studied. Methods for studies on the effect of light intensity on the behavior of fish is described.

8956. Reif, Charles B., and Donald W. Tappa (Wilkes College, Wilkes-Barre, Penn.). 1966. SELECTIVE PREDATION: SMELT (Osmerus mordax) AND CLADOCERANS IN HARVEYS LAKE (PENNSYLVANIA). Limnol. Oceanogr. 11(3): 437-438; Biological Abstracts, 47(24): Abst. No. 115689. 1966.

Although the evidence presented here is circumstantial, the change in species of cladocerans in Harveys Lake seems to support the contention of Brooks and Dodson (1965) that the differential predation of an introduced fish has favored the survival of a species whose individuals are smaller than those of the eradicated species.

8957. Neustroev, G.V., and V.N. Podymakhin. 1966. RESPIRATION OF Salmo salar EGGS WHEN THERE IS RADIOACTIVE CONTAMINATION OF THE WATER. Radiobiologiya 6(1): 115-116. Illus.; Biological Abstracts, 47(24): Abst. No. 117874. 1966.

The eggs developed in an aquarium containing Cs^{137} at concentrations of 1.10^{-6} curies/liter within several hours after fertilization until the end of the experiment. The oxygen consumption of both the control and experimental eggs increased, but it always remained higher in the experimental eggs than in the control eggs. It can be concluded that the respiration rate increased in the irradiated eggs and larvae. --A. Fast.

8958. Khalturin, D.K. (State Res. Inst. Lake River Fish Ind., Leningrad, USSR). 1965. SIGNIFICANCE OF CERTAIN TAXONOMIC CRITERIA OF SALMON. Dokl

Akad Nauk SSSR 165(3): 711-713; Biological Abstracts, 47(24): Abst. No. 119874. 1966.

The form of the otoliths was compared in Salmo salar, S. trutta and S. trutta m. lacustris from 6.1 to 17.2 cm long. There are differences in the form of the otoliths in these young fish as well as in adults. It was also observed that the ratio of the fork length of sexually mature individuals to the length as ordinarily measured in the fishery showed consistent differences between various populations. --F. Fry.

8959. Bergeron, Julien, and Leon Tremblay (Sta. Biol., Mar., Grande-Rivière, Quebec, Canada). 1964. MOVEMENTS OF ADULT SALMON (Salmo salar) TAGGED IN THE GASPÉ PENINSULA FROM 1955-1957. Trav Pecheries Quebec, 3. 101-116. Maps; Biological Abstracts, 48(1): Abst. No. 610. 1967.

In the course of 3 years 513 kelts and 675 adult salmon (captured from 1-5 months before spawning) were marked. The percentage of recaptures varied between 2.8 (Port-Daniel River) and 27 (Grand River). The recaptures of kelts indicate that these salmon return toward their river of origin after a sojourn at sea. The salmon captured and marked at the mouth of the Grand River clearly returned to the spawning grounds of this river. Those having been at sea only 1 year, marked at the Port-Daniel River, did not seem to differ in movement from adult salmon marked at the same place. Adults marked at Carleton traveled more to the west toward the spawning grounds of rivers situated at the base of Chaleur Bay. (Auth. summ. transl.)

8960. Manzer, J.I., and M.P. Shepard (Fish. Res. Board Can., Biol. Sta., Nanaimo, B.C., Canada). 1963. MARINE SURVIVAL, DISTRIBUTION AND MIGRATION OF PINK SALMON (Oncorhynchus gorbuscha) OFF THE BRITISH COLUMBIA COAST. Stud Sta Fish Res Board Can 1962(712): n.p. Illus. Maps; From: Univ. Brit. Columbia Inst. Fish. MacMillan Lect Fish Symp. Pink Salmon 1960, 113-122. 1962; Biological Abstracts, 48(1): Abst. No. 642. 1967.

There is much good evidence that fluctuations in the production of pink salmon are caused by changes in the freshwater environment. There is increasing evidence, particularly in recent years, that the marine environment also is important in causing marked variations in the abundance of the species. In some years it is known that these variations have been great. Further, there are indications that the distribution and migrations of pink salmon can be quite different in some years, presumably in response to changes in the marine environment. While information on pink salmon during their marine residence is rapidly accumulating it is recognized that the studies on this phase of the life history are only in their initial stages. At present, these studies are mainly concentrated on determining distribution and migrations of pink salmon, and on their ecology. This is a necessary step if the factors causing fluctuations in marine survival are to be isolated and their relative importance evaluated. (Authors)

8961. Power, G. (Dept. Biol., Univ. Waterloo, Waterloo, Ontario, Canada). 1966. OBSERVATIONS ON THE SPECKLED TROUT (Salvelinus fontinalis) IN UNGAVA. Natur Can 93(3): 187-198. Illus. (French summ.); Biological Abstracts, 48(1): Abst. No. 659. 1967.

Speckled trout (Salvelinus fontinalis) are widely distributed in Ungava and abundant south of the tree line. Inland the majority taken by angling or in gill nets weigh between 0.5 and 3.0 lb, anadromous fish are heavier. The diet consists of aquatic insect larvae supplemented with terrestrial insects, mollusks and fish. Spawning occurs in early September. A 300 mm trout produces 800 mature ova. Fry attain lengths of between 40 and 70 mm during the first summer. Populations are unexploited and there are many large fish. Because of the habit of congregating in fast water for feeding during the summer, stocks may be depleted by angling when the region becomes more accessible. (Auth.)

8962. Strel'tsova, S.V. 1964. ADAPTATION OF CARP AND RAINBOW TROUT TO VARIOUS CONCENTRATIONS OF DISSOLVED OXYGEN. Izv Gos Nauch-Issled

Inst Ozern Rechn Rybn Khoz 58. 17-26. (Engl. summ.). From: Ref Zh Biol, 1965, No. 16I62. (Translation); Biological Abstracts, 48(1): Abst. No. 672. 1967.

To elucidate the process of adaptation of trout and carp to various concentrations of dissolved O_2, the author investigated the rate of respiration and the O_2 threshold by means of a non-flow respirometer. One group of fish was kept under conditions of low O_2 content (20-29% of saturation), another at a high O_2 content (170-180% of saturation), and the control group at 100% saturation. The adaptation time was determined from the change in respiratory rate and O_2 threshold, which were measured several times in the course of one month. At a temperature of 1-2° C, adaptation of 2-summer trout to low O_2 content set in on the 22nd day, as manifested by a reduction in O_2 uptake rate from 178.2 mg/kg/hr. to 82.2 mg/kg/hr. and by a reduction of O_2 threshold from 1.07 to 0.84 mg/l. Ten-month-old trout became accustomed to a low O_2 content on the 27th day, and to an O_2 excess on the 17th, the O_2 threshold changing from 0.95 to 0.67 and 1.44 mg/l, respectively. With a 15° increase of temperature, adaptation was speeded up and proceeded faster in fingerlings (6 days) than in 2-year-olds (13 days). Carp fingerlings weighing 40 g were able to adapt themselves faster than 2-year-olds, and the changes in their O_2 threshold were more pronounced.

8963. Enger, Per S. (Inst. Physiol., Univ. Oslo, Oslo, Norway). 1966. ACOUSTIC THRESHOLD IN GOLDFISH AND ITS RELATION TO THE SOUND SOURCE DISTANCE. Comp Biochem Physiol 18(4): 859-868. Illus.; Biological Abstracts, 48(1): Abst. No. 1931. 1967.

Acoustic threshold levels were obtained for goldfish in classical conditioning experiments, stimulating the fish with pure tones of different frequencies (50-5000 c/s). The threshold intensity for response has been established for different distances (0.1-2.0 m) between the fish and the underwater loudspeaker. Sound pressure thresholds (given in decibels re 1 μBar) for frequencies below 600-700 c/s are strongly dependent upon distance to the sound source, while no significant threshold differences were found for higher frequencies. Tests with an air loudspeaker gave thresholds similar to those obtained with the underwater loudspeaker at 2 m distance. Lowest thresholds (-42 to -45 db) are in the 1000-1500 c/s range, increasing to -10 db for 5000 c/s and to -6 db (at 2 m distance) or -38 db (at 0.1 m distance) for 50 c/s. The variation in threshold with distance is probably due to the physical characteristics of the sound stimulus. Close to the sound source, i.e., within a distance equal to the wavelength divided by 2π, the near-field water displacement amplitude is considerable. Calculated particle displacement at threshold is roughly the same for all distances for any given frequency and particle acceleration is the same for all distances and frequencies. (Auth.)

8964. Halver, John (Bur. Sport Fisheries and Wildlife, Western Fish Nutrition Lab., Seattle, Wash.). 1965. HEPATOMAS IN FISH. In: Primary hepatoma, University of Utah Press: Salt Lake City. 103-112. Illus.

The susceptibility of rainbow trout to the induction of primary hepatomas by various components of the diet and carcinogens known to induce cancer in mammals was tested. The lipid component and to a less extent the carbohydrate fractions of the dry ration known to be associated with the appearance of hepatomas were found to increase the incidence of those neoplasms. This also was true of a wide variety of carcinogens when included in a diet otherwise innocuous. Especially effective was aflatoxin when included only as a trace (5 parts per billion). (Auth.)

8965. Von Sallmann, Ludwig, John E. Halver, Eleanor Collins, and Patricia Grimes (Ophthalmol. Br., Nat. Inst. Neurol. Dis. and Blindness, Bethesda, Maryland). 1966. THIOACETAMIDE-INDUCED CATARACT WITH INVASIVE PROLIFERATION OF THE LENS EPITHELIUM IN RAINBOW TROUT. Cancer Research, 26(8 Pt. 1): 1819-1825. Illus.; Biological Abstracts, 48(1): Abst. No. 2946. 1967.

Cataracts developed in 90% of rainbow trout maintained on a thioacetamide diet for prolonged periods of time. The most striking feature in the histology of these lenses was a massive proliferation of the lens epithelium and its transforma-

tion to a pleomorphic cell mass which sometimes replaced a great portion of the anterior lens cortex. The profuse invasion of the epithelial cells, their disorganization, and the presence of forms similar to Darier cells and epithelial pearls suggest a tumorous growth pattern. The relation of the epithelial proliferation to fiber damage is not clear nor is the role of the carcinogenic properties of thioacetamide in the development of the lens pathology. (Authors)

8966. Protasov, V. R., A. A. Darkov, and L. K. Malinin (A. N. Severtsov Inst. Anim. Morphol., Acad. Sci. USSR, Moscow, USSR). 1966. "VISUAL IMAGES" IN RECOGNITION AND SIGNALLING OF FISHES. Izv Akad Nauk SSSR Ser Biol 31(1): 59-75. Illus. (Engl. summ.); Biological Abstracts, 48(1): Abst. No. 5015. 1967.

In the majority of fish as well as in many mammals and birds, a system of signalling by means of "visual images" is well developed. Visual signals in fish consist of characteristic postures and movements which have quite a definite information significance. The following types of "visual images" which serve as signals are distinctly established: postures of nutrition, of danger, of passive defense, of defeat, of female attraction, and of calling young fish. In different fish spp. each of these types has its own peculiarities and is characterized by some common attributes. That is why many visual signals (those of danger, of nutrition, of defense) are used by fish in their intra- and inter-species relations. Fish exhibit the greatest amount of signal during spawning. They are sp. specific and are used by fish only in their intraspecies relation. An exchange of these signals among fish of opposite sexes has the character of a "dialogue". Static attributes (color, size, form) are important in signalling. In the act of recognizing individual characteristics, features of objects are of a decisive value. The practical result is the possibility to construct visual traps according to the principle of relative but not absolute resemblance of the object imitated. (Authors)

8967. Roeder, Martin, and Rachel H. Roeder (Dept. Biol. Sci., Florida State Univ., Tallahassee, Fla.). 1966. EFFECT OF IRON ON THE GROWTH RATE OF FISHES. J. Nutr. 90(1): 86-90. Illus.; Biological Abstracts, 48(2): Abst. No. 6267. 1967.

To determine the nutritional requirement for iron in fish growth, the effect of daily addition of supplemental ferrous sulfate on the growth of Xiphophorus helleri and Xiphophorus maculatus (the swordtail and platyfish) was measured by determination of weight gain and hematocrit levels. Both variables increased as a result of the added iron. The effectiveness of the treatment diminished as sexual maturity was approached. Treatment with ferrous sulfate led to an increase in growth rate even in fish fed maximally with live brine shrimp. Ferric salt was not judged effective. Addition of ferrous iron also significantly decreased the mortality from hatching to maturity. (Authors)

8968. Cairns, John, Jr., Arthur Scheier, and Nancy E. Hess (Acad. Natur. Sci. Philadelphia, Philadelphia, Penn.). 1964. THE EFFECTS OF ALKYL-BENZENE-SULFONATE ON AQUATIC ORGANISMS. Ind Water Wastes 9(1): 22-28. Illus. From: Proc. 4th Amer. Symp. on Industrial Waste Control; The Johns Hopkins Univ. and the State of Maryland: 43-54. May 6, 1963; Biological Abstracts, 48(2): Abst. No. 5811. 1967.

The diatom populations which were used as representative primary producers were only affected, in terms of growth capabilities, by concentrations of alkyl-benzene-sulfonate well in excess of those reported as typical concentrations from various United States streams. Furthermore, considerably higher concentrations were required to repress growth entirely. The invertebrate selected as representative of lowland streams, Physa heterostropha, had 100% survival for 120 hours at concentrations in excess of those reported as typical concentrations from various United States streams. This is in general agreement with the results of Surber and Thatcher (1963) for the gastropod snail Goniobasis. Although the tests would have had greater significance in predicting the effects of long term exposure had the Physa been exposed for an entire life cycle 2 factors should be noted in this

regard: (1) virtually all deaths occurred in the first 24 hours of exposure with those specimens surviving (in all cases but one out of several hundred test specimens) lasting for the entire 124 hour test period; and (2) Physa has a rather short life cycle. The pumpkinseed sunfish survived several months exposure to concentrations of alkyl-benzene-sulfonate as high as 9.8 ppm although gill damage was apparent. A combination of factors could account for this phenomenon. Some of these factors might be (1) an "oversupplied" respiratory system in terms of needs or (2) compensating mechanisms such as increased heart rate and increased red blood cell production.

8969. Simco, Bill A., and Frank B. Cross. 1966. FACTORS AFFECTING GROWTH AND PRODUCTION OF CHANNEL CATFISH, Ictalurus punctatus. Univ. Kansas Publications Museum of Natural History 17(4): 193-256. Illus.; Biological Abstracts, 48(2): Abst. No. 5864. 1967.

Production of channel catfish under various experimental conditions was carried on in 1/10-acre earthen ponds and other facilities. The weight of channel catfish that our ponds supported without supplemental feeding was 98 to 183 lb/acre. By daily feeding of pelleted rations, yields of 550 to 2,215 lb of channel catfish per acre were obtained. In open ponds and subdivided ponds, supplemental feeds containing 30% protein produced as many pounds of catfish as did feeds containing larger amounts of protein. Gains made on feeds containing 20% protein were consistently less than those obtained on feeds containing higher levels of protein. Catfish that received supplemental feeds had a higher condition index than did wild catfish. Experiments in subdivided ponds and in open ponds indicated that feeding-rates of 2 to 3% of fish-weight per day probably are the most favorable rates for economic production of channel catfish. High stocking-rates usually resulted in higher yields of fish than did lower stocking-rates at some sacrifice in the average size of individual fish. The carrying capacity of the ponds varied from year to year. As the average weight of the fish increased the diurnal fluctuation of dissolved O_2 increased. Generally, the growth-rate and condition index of the catfish declined (1) as the standing crop increased, (2) as the alkalinity decreased, and (3) as the O_2-level became more variable within each 24-hour cycle. Levels of pH and dissolved oxygen were highly correlated in these ponds. Where fish were fed, their growth-rate was not found to correlate highly with alkalinity nor with other chemical factors that were analyzed. But, the condition index of the fish was lowest when daily values of dissolved O_2 and of pH were most variable. When the average weight (and standing crop) of fish was greatest, daily fluctuations in pH and O_2-content were extreme, total dissolved solids were highest, and alkalinity was lowest. Where fish were fed, production was poor (feed was not utilized well) when water-temperatures fell below 70° F in early autumn. (Authors)

8970. Cory, Robert P., and Finn Wold (Dept. Chem. and Chem. Eng., Univ. of Illinois, Urbana, Ill.). 1966. ISOLATION AND CHARACTERIZATION OF ENOLASE FROM RAINBOW TROUT (Salmo gairdnerii gairdnerii). Biochemistry 5(10): 3131-3137. Illus.; Biological Abstracts, 48(2): Abst. No. 6039. 1967.

Enolase has been purified and crystallized from the white skeletal muscle of rainbow trout. The crystalline enzyme contains 3 electrophoretically distinct enolases, and since the same ratio of these 3 enzyme forms was present in the original muscle extract, it is concluded that the 3 forms are not artifacts of isolation. Working with the mixture of the 3 forms, the trout muscle enolase has been characterized with respect to physical, chemical, and biochemical properties. The crystalline enzyme was homogeneous in the ultracentrifuge and had a molecular weight of 91,000. In contrast with enolases from yeast and rabbit, it contains both sulfhydryl and disulfide groups. Its catalytic properties are very similar to other enolases both with respect to kinetic constants and inhibition by fluoride, and with respect to the absolute requirement for divalent metal ion. (Authors)

8971. Higashi, Hideo, Tokugoro Kaneko, Seinosuke Ishii, Munehiro Ushiyama, and Takao Sugihashi. 1966. EFFECT OF ETHYL LINOLEATE, ETHYL

LINOLENATE AND ETHYL ESTERS OF HIGHLY UNSATURATED FATTY ACIDS ON ESSENTIAL FATTY ACID DEFICIENCY IN RAINBOW TROUT. J. Vitaminol. (Osaka) 12(1): 74-79. Illus.; Biological Abstracts, 48(2): Abst. No. 6248. 1967.

In order to determine if essential fatty acid (EFA) is necessary for rainbow trout as it is for mammals, the fish raised on a fat-free diet long enough to manifest deficiency symptoms were given ethyl esters of linoleic, linolenic and highly unsaturated fatty acids and the following effects were observed. The posterior part of those fish fed only the fat-free diet for 3 months was discolored and hardened. The posterior fin was worn out. In the extreme cases, the fin had almost disappeared, leaving the terminals of spiral column. Many of the fish died in this group. These symptoms might be caused by EFA deficiency. The fat-free diet was inferior to the diets containing fatty acid esters for weight gain and for efficiency of the diet. Among the three fatty acid esters, highly unsaturated fatty acid esters were the best in the accumulation and efficiency of the diet, showing minimum mortality. Ethyl linoleate was the next and ethyl linolenate was the last of the 3. Of each ester a 200 μg dose was better than 50 μg. In this experiment, fish fed the diets containing more than 50 μg esters/g of body weight per day, failed to cause deficiency symptoms, though a further experiment may be necessary to determine the minimum requirement of these fatty esters. A recovery test was carried out with rainbow trout which had been fed the fat-free diet for 2 months. In the fat-free diet group, the symptoms of the deficiency could still be observed, but in the groups containing the 3 kinds of esters at the rate of 500 μg/g of body weight per day, such symptoms were not observed. (Authors)

8972. Woodhead, A. D. (Heron Island Res. Sta., Great Barrier Reef, Australia). 1966. EFFECTS OF THYROID DRUGS ON THE LARVAE OF THE BROWN TROUT, Salmo trutta. J. Zool. Proc. Zool. Soc. London, 149(3): 394-413. Illus.; Biological Abstracts, 48(2): Abst. No. 7625. 1967.

Brown trout larvae, Salmo trutta L., were reared from hatching in solutions of the thyroid hormone, thyroxine, and the thyroid inhibitors, thiourea and thiouracil. Thyroxine treatment profoundly affected morphogenesis, while thiourea and thiouracil had little morphogenic effect. Thyroxine treatment caused abnormal growth of the head, and stimulated the rate of differentiation of the fins from the primitive fin fold, and the absorption of the external yolk sac. The epidermis and dermis were considerably thicker in thyroxine-treated larvae than in control fish, and silvering of the skin was induced. Thiourea and thiouracil produced few morphogenic effects, but such effects as were evident were usually similar with both drugs, and opposite to those caused by thyroxine treatment. It has previously been shown that untreated brown trout larvae show a gradual increase in swimming activity during development, finally becoming completely active throughout an observation period (15 minutes) on the fourteenth day after hatching. Thyroxine treatment accelerated the development of swimming activity, and the treated larvae became fully active one to two days before the controls. Thiourea treatment strongly inhibited the development of swimming activity; this effect was in marked contrast to its weak effects on morphogenesis. Thyroxine-treated larvae were significantly shorter than untreated fish. During the first weeks after hatching, brown trout larvae live entirely upon their yolk-sac reserves, having a "closed" system of nutrition. It is suggested that thyroxine treatment stimulates both developmental and maintenance metabolism in the larvae; an increased maintenance requirement would leave less food available for growth, thus resulting in a smaller final size. Thyroxine and thiourea treatment both affected the pigmentation of the larvae. Thyroxine-treated fish had significantly greater numbers of melanophores than the controls, whereas there were fewer in the thiourea-treated group. The state of expansion of the melanophores differed when the three groups were left for a period in darkness; the melanophores of the thyroxine-treated fish contracted, while those of the thiourea-treated larvae were fully expanded, with the control group intermediate. After a period in the light the state of expansion of the melanophores in all the larvae, experimentals and controls, approached a similar condition. A comparison of the melanin content of the bodies of the larvae showed that thyroxine-treated fish contained less melanin than the controls, and

thiourea-treated fish more. The significance of these findings is discussed. It is suggested that thiourea has a direct effect upon pigmentation, rather than an indirect effect caused by blockage of thyroid activity in the larva. (Auth.)

8973. Kok, L. T., and M. D. Pathak (Fac. Agr., Univ. Malaya, Kuala Lumpur, Fed. Malaysia). 1966. TOXICITY OF LINDANE USED FOR ASIATIC RICE BORER CONTROL TO THREE SPECIES OF FISH. J. Econ. Entomol. 59(3): 659-663. Illus.; Biological Abstracts, 48(2): Abst. No. 9797. 1967.

Application of lindane to the water in rice paddies may soon become a popular way to control the Asiatic rice borer, Chilo suppressalis (Walker). Its toxicity to tawes, tilapia, and carp, common fish in the rice fields, was investigated. Dol granule, a granular formulation containing 6% lindane and 94% carrier, was the toxicant source. In laboratory tests conducted in aquaria containing water alone, all species suffered high mortality, even at 1.0 ppm lindane. This mortality was remarkably reduced when the tests were conducted in aquaria containing a 3-inch layer of Maahas clay soil. Furthermore, there was a 5 to 10 times increase in LC_{50} values of these species in tests conducted in water 10 cm deep in the field. The lindane susceptibility of the different species was in the order of tilapia< tawes< carp. All of the species had less than 4% mortality when lindane was used at the rate of 2 kg/hectare in ponds containing water 10 cm deep. When applied to the paddy water, this rate of lindane effectively controls the Asiatic rice borer. (Auth.)

8974. Andersson, Evert (Inst. Limnol., Uppsala, Sweden). 1965. ECOLOGICAL NOTES ON Acanthobdella peledina Grube FOUND ON GRAYLING AND BROWN TROUT. Rep. Inst. Freshwater Res. Drottningholm 46. 185-199. Illus.; Biological Abstracts, 48(2): Abst. No. 9801. 1967.

In the Heikka area of the Pite River, 39% of the grayling, Thymallus thymallus and 34% of the brown trout, Salmo trutta, had Acanthobdella attached to fins in the 1963 and 1964 summers. Fish under 30 cm were infested less than larger fish but there was no sex difference in degree of infestation. A few leeches appear in late June. They become commoner and larger in July and August. In the first month of infestation at least, the leeches have no noticeable effect on growth rate of length-weight relationship of the fish. Acanthobdella were usually on the dorsal fin but also infested other fins. Of 104 Acanthobdella-infested grayling, 7% had over 20 leeches. Maximum numbers found were 60 on one grayling and 103 on one brown trout. Some Acanthobdella were yellow instead of grey-green to yellow-brown with dark crossbands. --K. D. Carlander.

8975. Breder, Charles M., and Donn Eric Rosen. 1966. MODES OF REPRODUCTION IN FISHES. xv+941 p. Natural History Press: New York. Pr. $17.50; Biological Abstracts, 48(2): Abst. No. 10349. 1967.

About 10% of the known fish spp. are mentioned herein. Data on fish reproduction has been arranged within the framework of current fish classification, and organized into 7 major analytical categories. Coverage of each group includes the following: breeding season, breeding site, migration, secondary sex characters, sex discrimination, competition for mates, courtship, mating, and parental care. Each group is accompanied by charts in which the chief reproductive characteristics are arranged in tabular fashion and compared with current ideas of morphological relationship. Besides academic usefulness, this volume suggests by implication, innumerable problems that should appeal not only to the ichthyologist, morphologists, physiologist, endocrinologist, and psychologist, but also to aquaria enthusiasts, fishery biologists, and students of zoology seeking worthwhile thesis problems. Answers to many pertinent questions are present in these pages, and, if not, the extensive documentation gives pertinent leads into the special literature. The volume has a systematic section of 594 pages, a summary of 13 pages, 55 pages of charts, a comprehensive bibliography and addendum of 231 pages, and a convenient index of scientific names. --R. Sutcliffe.

8976. Gammon, James R. (DePauw Univ., Greencastle, Indiana). 1964. THE DISTRIBUTION OF FISHES IN PUTNAM COUNTY, INDIANA, AND VICINITY. In: Spring Meeting, McCormick's Creek State Park, 8-9 May, 1964. Fall Meeting, Indianapolis, 29-31 October, 1964. Proc. Indiana Acad. Sci., 74. 353-359; Biological Abstracts, 48(2): Abst. No. 10351. 1967.

The distribution of fishes in an area of approximately 1000 square miles including all of Putnam County and parts of Clay, Parke, Montgomery, Boone, Hendricks and Morgan Counties was studied during 1962, 1963 and 1964. Collections were made at 56 sites on the mainstreams and tributaries of Raccoon Creek north of the town of Mansfield, Deer Creek, and Big Walnut and Mill Creeks above their junction with each other. A total of 60 spp. of fish belonging to 13 families were identified. Two specimens of catostomids have been identified tentatively as Moxostoma breviceps. Ambloplites rupestris rupestris, Etheostoma caeruleum and Etheostoma flabellare were not found above Cataract Falls, but were widely distributed and fairly abundant elsewhere. Thirteen other spp. which were not collected above the Falls were taken at 6 or more sites elsewhere. Within the past 20 years, the gizzard shad (Dorosoma cepedianum) and the river chub (Hybopsis micropogon) have entered the area and have become firmly established in some stream systems. (Auth.)

8977. Caudill, Harry M. 1966. AN OFFENSE AGAINST AMERICA. A MOUNTAIN IS RAVAGED, A VALLEY SHATTERED. Audubon 68(5): 356-359. Illus.; Biological Abstracts, 48(3): Abst. No. 10430. 1967.

The conventional workings of economic and corporate decisions provide a momentum far too great to be matched by local county governments or even state statutes. Only a national conscience and a federal strength of purpose can effectively meet the issue. And as the destruction spreads across Appalachia, the hills, the hollows, the streams, the fish and the wildlife of the yet unravaged lands, all await the answer. (From auth.)

8978. Leopold, A. Starker, and Justin W. Leonard. 1966. ALASKA DAM WOULD BE RESOURCES DISASTER. Audubon 68(3): 176-178. Illus.; Biological Abstracts, 48(3): Abst. No. 10435. 1967.

Although fiscal provision could be made in enabling legislation to mitigate wildlife and fisheries losses, no practical means have been proposed for replacing the animals and habitats that would be destroyed by Rampart Dam. (Authors)

8979. Berge, G. 1964. RADIOACTIVITY IN FISH. Arsberet Vedkommende Norges Fiskerier 1963(2): 34; Biological Abstracts, 48(3): Abst. No. 10837. 1967.

Fish and other organisms were studied for radioactivity. Total beta activity in Barents Sea fish varies throughout the year. A maximum was recorded in the summer which corresponded to 4 or 8 times the natural K^{40}-level; the level sank toward late fall and was normal at year's end. This regular pattern is only disturbed by tests such as those at Novaya Semlya in 1962; it is mainly due to the organic cycle. In the summer maximum the following elements were detected: Mn^{64}, Zn^{65}, Ru^{106}, and Cs^{137}. Radioactivity of filtrable material in the Sea of Norway corresponds to the plankton mass. --A. M. Hegland.

8980. Sathyanesan, A. G., and Walter Chavin (Wayne State Univ. Dept. Biol., Detroit, Michigan). 1966. EFFECT OF WHOLE-BODY IRRADIATION ON THE PREOPTICO-HYPOPHYSEAL NEUROSECRETORY SYSTEM AND THE HYPOPHYSIS OF THE GOLDFISH Carassius auratus L. Radiat. Res., 29(1): 100-113. Illus.; Biological Abstracts, 48(3): Abst. No. 10902. 1967.

The preoptico-hypophyseal neurosecretory system and the hypophysis of the goldfish showed wide variations in response to a given specific dose of irradiation. The neurosecretory cells did not show prominent histopathological changes within 5 days after irradiation, irrespective of the dose size. Degeneration or degranulation of the large cells of the pars magnocellularis resulting in a chromophobic condition appeared 11 to 21 days postirradiation at all but the highest dose levels.

At 70 kR, such changes appeared at 6 days. Some axonal injury was present. Evidence of recovery was present at 28 to 42 days. Of the 189 irradiated fishes studied histologically, 10 showed marked morphological hypophyseal changes including hypophyseal distortion and infiltration of connective tissue separating portions of the pituitary. However, the basic cell types could be readily identified. In other fish, the components of the pituitary could not be identified tinctorially, owing to complete degranulation. Often the acidophils of the rostral pars distalis were more highly chromatic than those of the caudal pars distalis. The hypophyseal and neurosecretory cell radiation induced alterations were not correlated. (Authors)

8981. Mills, Harlow B., William C. Starrett, and Frank C. Bellrose (Illinois State Natural History Survey, Urbana, Ill.). 1966. MAN'S EFFECT ON THE FISH AND WILDLIFE OF THE ILLINOIS RIVER. Illinois Natural History Survey Biological Notes 57. 1-24. Illus.; Biological Abstracts, 48(3): Abst. No. 10979. 1967.

A documented report of changes in the Illinois River, primarily in the past 75 years, with emphasis on biological modification brought about by man's activities. The report is divided into sections discussing the river and the physiography of its basin, changes in human populations and activities, turbidity, dissolved oxygen, benthos, aquatic vegetation, fish, waterfowl, and other birds. Since the turn of the century there have been dramatic changes, some coming on almost instantaneously and others gradually. Changes in the biota of the river since the late 1890's have been variable; sometimes, some elements have responded favorably, but the net of all changes has been a drastic reduction in the plants and animals that live on or in the river. --H. B. Mills.

8982. Hardy, J. L. (Dow Chemical Co., Midland, Mich.). 1966. EFFECT OF TORDON HERBICIDES ON AQUATIC CHAIN ORGANISMS. Down Earth 22(2): 11-13. Illus.; Biological Abstracts, 48(3): Abst. No. 11094. 1967.

The active ingredient of tordon is 4-amine-3, 5, 6-trichloropropionic acid. Daphnia maintained in water containing 1 ppm equivalent of tordon 22K herbicide developed and reproduced normally over a long period with no build-up of herbicide in their tissues. Guppies kept in water of this same concentration of tordon and fed on a diet of the Daphnia were normal in appearance, behavior, and reproduction. Presence of 1 ppm of tordon herbicide in the water did not retard growth of algae or have any adverse effect on the Daphnia which fed on the algae, or subsequently on fish which fed on the Daphnia. --V. R. Gardner.

8983. Bernatowicz, Stanislaw. 1965. EFFECTS OF MOWING ON THE OCCURRENCE OF MACROPHYTES IN THE DGAL MALY LAKE. Acta. Hydrobiol., 7(1): 71-82; Biological Abstracts, 48(3): Abst. No. 11130. 1967.

The cutting down of helophytes and of shore brush led to the exposure and transformation of the littoral zone. In areas devoid of reed, Ceratophyllum demersum, Potamogeton perfoliatus, and Batrachium circinatum developed. In the lake, new species appeared: Schoenoplectus tabernaemontani, Potamogeton lucens, and Stratiotes aloides. The retreat of reed and replacement by fine-leaved vegetation improved conditions for phytophilous fish, and the summer mowing of reed is recommended as a basic ameliorative means of increasing the fish production. --Courtesy NSF (PL 83-480) 1966.

8984. Besse, P., J. C. Levaditi, J. C. Guillon, and P. De Kinkelin (Sta. Hydrobiol. Continentale Paris, Paris, France). 1965. OCCURRENCE OF VIRAL DISEASES IN THE RAINBOW TROUT HATCHERIES IN FRANCE. FIRST HISTOPATHOLOGICAL RESULTS. In: Symposium on viral diseases of poikilothermic vertebrates, Kearneysville, West Virginia, 23-26 September, 1964. Ann. N. Y. Acad. Sci., 126(1): 543-546; Biological Abstracts, 48(3): Abst. No. 11131. 1967.

At the time being, in France, histological investigation allowed us to find 2 diseases which are undoubtedly due to viruses: viral septicemia of the rainbow trout (Salmo gairdneri) and the ulcerative form of infectious hydrops of the carp (Cyprinus carpio). However, some other viral diseases are likely to exist among breeding fish, and we paid particular attention to the lymphoid hepatitis of the rainbow trout. (Authors)

8985. Blaxter, J.H.S., and B.B. Parrish (Marine Lab., Aberdeen, Scotland). 1965. THE IMPORTANCE OF LIGHT IN SHOALING, AVOIDANCE OF NETS AND VERTICAL MIGRATION BY HERRING (Clupea harengus). J. Cons. Cons. Perma. Int. Explor. Mer. 30(1): 40-57. Illus.; Biological Abstracts, 48(3): Abst. No. 11135. 1967.

The diurnal changes in behavior of herring have been studied at sea and related to observations of shoaling and avoidance of nets in tanks. In tanks the degree of shoaling depended on light intensity. Shoaling dropped to 50% of the daylight value at threshold light intensities of 5×10^{-1} to 3×10^{-3} mc (meter-candle) depending on the fish and on the circumstances of the experiment. Vision also played an important role in the avoidance of nets. Herring in tanks started to swim into nets which they avoided in daylight when the light intensity reached a threshold value of 3×10^{2}- x 10^{-3} mc, depending on the visibility of the net. At sea echo-traces of herring were found by day at light intensities from 10^{3}-10^{0} mc. There seemed to be no preferendum, but the fish responded to large changes of light intensity, moving towards the surface when the illumination reached 10^{1}-10^{-1} mc. The shoals then tended to disperse as the light decreased below the shoaling threshold (taken as 10^{-1} mc). The fish remained by night in light intensities of 10^{0}-10^{-4} mc and re-formed the shoals when the illumination at dawn reached 10^{1}-10^{-1} mc. Records of measurements of light intensity by night from May to August suggest that drift net fishing could be made more efficient, since the light is above the threshold value for seeing nets (taken as 6×10^{-3} mc) throughout the night for a considerable part of the fishing season. (Authors)

8986. Chaudhuri, H., S.B. Singh, and K.K. Sukumaran (Cent. Inland Fish. Res. Substa., Cuttack, India). 1966. EXPERIMENTS ON LARGE-SCALE PRODUCTION OF FISH SEED OF THE CHINESE GRASS CARP, Ctenopharyngodon idellus (C. and V.) AND THE SILVER CARP, Hypophthalmichthys molitrix (C. and V.) BY INDUCED BREEDING IN PONDS IN INDIA. Proc. Indian Acad. Sci. Sect. B 63(2): 80-95; Biological Abstracts, 48(3): Abst. No. 11139. 1967.

The experiments to induce spawning in the Chinese grass carp, Ctenopharyngodon idellus and the silver carp, Hypophthalmichthys molitrix, grown in ponds, were successfully conducted during June-August 1964. The breeders consisted of induced-bred as well as of the original stock. Large-scale production of fish seed was achieved yielding 2.4 lakhs (240,000) of fry of grass carp and 3.57 (357,000) lakhs of silver carp. The results obtained suggest the possibility of commercial production of seed of these Chinese carp. Induced fish breeding techniques as developed for the Indian major carps were adopted in general; however, the response was not found to be quite satisfactory, because stripping and artificial insemination of eggs had to be resorted to in most of the cases. The above technique was, therefore, modified and in place of 2 injections at an interval of 6 hours, the female breeders received the hormone in 3 gradually increasing doses at a closer interval of 3 hours. With this slight modification in the technique, encouraging response was obtained. On 3 occasions, grass carp were observed to have naturally spawned inside the hapa and healthy fry were produced. The total dose of hormone administered varied from 9 to 12 mg/kg body-weight of the recipient female and 2-4 mg/kg body-weight of the recipient male, and was ordinarily found effective in the case of both grass and silver carp. On one occasion, when ideal weather condition was prevailing, a single low dose of hormone 3-4 mg/kg body-weight of female spawners induced successful spawning in 3 sets of silver carp. The donors of glands were the Indian major carps (Rohu and Mrigal) and silver carp. The entire operation of injecting and stripping the spawners usually took 8 to 14 hours during the present series of experiments. The negative and poor results were due mostly to such female spawners where resorption of eggs had set in and also in several instances due to adverse physico-chemical conditions of water resulting in heavy mortality of developing eggs. (Authors)

8987. Fish, G.R. (Mar. Dept., Rotorua, New Zealand). 1963. SOME EFFECTS OF EXTERNAL CONDITIONS UPON THE WATER CONTENT OF RAINBOW TROUT IN NEW ZEALAND LAKES. Icthyologica 2(1/2): 76-84. Illus.; Biological Abstracts, 48(3): Abst. No. 11149. 1967.

The limnological conditions of 5 lakes near Rotorua have been studied during 1961 and 1962 and the state of the resident trout over this period has been determined by estimating the water present in their muscle tissues. These results have been correlated to show that the fish have, on the whole, a water content which is higher in those lakes that are more eutrophic and which consequently offer a less favorable environment for them. This conclusion is supported by evidence of the state of the various trout stocks as determined by routine netting and tagging programs made during the same years. (Auth.)

8988. Ghittino, Pietro (Piemonte Liguria, Torino, Italy). 1965. VIRAL HEMORRHAGIC SEPTICEMIA (VHS) IN RAINBOW TROUT IN ITALY. In: Symposium on viral diseases of poikilothermic vertebrates, Kearneysville, West Virginia, 23-26 September, 1964. Ann. N.Y. Acad. Sci., 126(1): 468-478. Illus; Biological Abstracts, 48(3): Abst. No. 11152. 1967.

The infectious disease of hatchery rainbow trout, known in Europe under various names, is now identified as "Viral hemorrhagic septicemia", in agreement with a decision reached during the first European symposium on fish disease at Turin, Italy, in 1962. The specific symptoms and pathologic-anatomical lesions exhibited by the disease during the first 5 years are described. VHS may develop an acute, a chronic, and a nervous form. The acute form is characterized by scattered hemorrhages which are especially evident in the skeletal muscles, in the air bladder, and in perivisceral adipose tissue; also by necrobiotic lesions of hepatocytes and kidney cells, a high mortality, and a rapid course of the disease. The chronic form exhibits low mortality, strong anemia, general hydroemia, and hemorrhages are generally absent. The nervous form shows swimming ataxia and no pathologic-anatomical lesions. The etiology is ascribed to a virus, in accordance with most authors, while a nutritional deficiency is now only considered to be a secondary factor. The high virulence of the disease is emphasized, and the results of new transmission tests are reported. According to these, VHS can be transmitted by bacteria-free pathological material, intraperitoneally inoculated, or spread on the gills. The incubation time (water temperature 15 to 16° C) is 7 to 15 days. Prophylactic measures are discussed. The failure of any specific treatment (antibiotics, sulfonamides, etc.) is confirmed. The poor results obtained by vitamin-supplement should be considered as the effects of a symptomatic treatment, and confirm once again the viral etiology of the disease. (Auth.)

8989. Kawashima, Rihei, and Ken-Ichirô Kyuûshin. 1964. ON THE ANALYSIS OF CHUM SALMON SCALE PATTERN BY USE OF AUTOCORRELATION COEFFICIENT. Bull. Fac. Fish. Hokkaido Univ., 15(1): 25-33. (In Jap. with Engl. summ.); Biological Abstracts, 48(3): Abst. No. 11166. 1967.

Salmon scales collected from 4 rivers along the coast of the Northern Pacific were measured and analyzed. It was concluded that the characteristics of scale pattern could be distinguished by correlogram and power spectra, and differences between each river stock could be recognized.

8990. Mayhew, James (Iowa State Conserv. Comm., Des Moines, Iowa). 1965. FISH GET READY FOR WINTER, TOO. Iowa Conserv. 24(11): 83. Illus.; Biological Abstracts, 48(3): Abst. No. 11193. 1967.

Experimental gillnetting in Red Haw Lake showed that crappies (Pomoxis spp.) were mostly within 9 feet of the surface during the summer stagnation period but were mostly below the 14-foot depth in winter. Bullheads (Ictalurus melas) were within 6 feet of the surface ice in the winter. Other species showed less seasonal vertical adjustment. --K. D. Carlander.

8991. McCracken, F. D. (Fish. Res. Board Canada, St. Andrews, N.B., Canada). 1964. COMPARISON OF TAGS AND TECHNIQUES FROM RECOVERIES OF SUB-AREA 4 COD TAGS. Stud. Sta. Fish. Res. Board Can. 1963(854): n.p. Illus. From: ICNAF Spec. Publication 4: 89-100; Biological Abstracts, 48(3): Abst. No. 11195. 1967.

Cod tagged near Lockeport, N.S., between June and October 1953 were

mainly retaken in the same region by Canadian hook-and-line fishermen. Cod tagged in the western Gulf of St. Lawrence near Miscou Island in the "summers" of 1955 and 1956 were retaken in the "summers" of succeeding years near the tagging area and in the "winters" off eastern Nova Scotia mainly by European vessels. Returns from the Gulf of St. Lawrence tagging came from both hooks and other trawls. Disk tags attached with stainless steel wire between the first and second dorsal fins of cod were much superior to hydrostatic tags attached in the same region, and much superior to strap tags attached ventrally to the caudal peduncle, both in total proportion returned and the length of time over which substantial returns were made. Total returns for disk tags reached 60% in the Lockeport tagging and about 40% in the Gulf of St. Lawrence tagging. In fisheries with various types of gear the size composition of cod tagged is important in determining proportions of different sizes retained, since otter trawls and hooks selected fish of different size. Otter-trawl returns were proportionally higher for small fish and proportionally lower for large fish than returns from hooks. (Auth.)

8992. Nikolyukin, N. I. 1965. THEORETICAL BASES OF HYBRIDIZATION IN FISH CULTURE. In: Theoretical bases of fish culture. Nauka: Moscow. 224-229. From: Ref Zh Biol, 1965, No. 21I102. (Translation); Biological Abstracts, 48(3): Abst. No. 11203. 1967.

In comparison with parental forms, hybrids possess certain advantages such as a faster growth rate, greater vigor, higher adaptive plasticity and more rapid sexual maturation. In practice (commercial culture) it is feasible to raise first-generation hybrids which exhibit in full measure the beneficial effects of crossing. To obtain fertile hybrids, it is essential to cross homologous forms possessing equal numbers of chromosomes. "Non-hybridization" (absence of fertile hybrids) is regarded as a kind of barrier which isolates the species and hinders their "mixing". Under natural conditions hybridization is very rare, although cases of mass hybridization are known, occurring usually when the reproductive conditions become disrupted. A species introduced into a new environment may be assimilated by an aboriginal species. The author stresses the need for expanding the cytogenetic study of fishes and hybrids, which is important in practical work. A greater similarity was found between the chromosomes of sterlet and beluga sturgeon (Huso huso), which belong to different genera, than between those of sterlet and Russian sturgeon. That is why the hybrid offspring of sterlet and white sturgeon are quite fertile while the hybrid offspring of sterlet and Russian sturgeon are not.

8993. Paiva, Melquiades Pinto (Estac. Biol. Mar., Univ. Ceara, Fortaleza, Ceara, Brazil). 1961. FISHING MAPS FOR TUNA ARE COMPILED FOR THE TROPICAL ATLANTIC OCEAN. Arq. Estac. Biol. Mar. Univ. Ceara 1(2): 1-110. Maps; Biological Abstracts, 48(3): Abst. No. 11207. 1967.

The fishing charts presented in this paper serve as a preliminary indication, regarding the relative densities of tunas and related species on the different months of the year, during the period of 1956-1960. Considered as the index of relative density was the percentage of baited hooks with catches of tuna and related species, by day of fishery. (From auth.)

8994. Parker, Robert R., Edgar C. Black, and Peter A. Larkin (Biol. Sta., Nanaimo, Brit. Columbia, Canada). 1964. SOME ASPECTS OF FISH-MARKING MORTALITY. Stud. Sta. Fish. Res. Board Canada 1963(842): n. p. Illus.; From: Int. Commission Northwest Atlantic Fish. Spec. Publication 4. 117-122; Biological Abstracts, 48(3): Abst. No. 11209. 1967.

It is observed and to be expected that marked fish suffer a mortality rate higher than that of the unmarked population. This additional mortality may be due, in the short term, to the combined effects of wounding and fatigue. More insidious but equally important may be long-term effects, which appear to accrue through bias on the part of predators toward marked individuals of prey. It is not known whether this bias is due to the disability of the prey, thus making them easier to capture, or to the recognition on the part of the predator of an individual item of

prey, thus partially destroying the statistical protection afforded by a school. Most or all of these effects may be reduced, but not entirely eliminated and it is recommended that an assessment of differential mortality be included in the design of experiments which involve capture and handling and marking of fishes. (Authors)

8995. Privol'nev, T.I. 1964. RELATIONSHIP OF FRESHWATER AND DIADROMOUS FISHES TO DIFFERENT SALINITIES. Izv. Gos. Nauch-Issled Inst. Ozern. Rechn Rybn Khoz. 58: 58-83. (Engl. summ.). From: Ref Zh Biol., 1965, No. 19I51. (Translation); Biological Abstracts, 48(3): Abst. No. 11213. 1967.

The tolerance of fishes to various concentrations of dissolved salt was studied experimentally. Seventeen species of fish were kept in aquaria at different salinities for 15-20 days. According to salinity tolerance, the fishes are divided into 2 groups. Group I includes fishes capable of withstanding a salinity not higher than 10-12 °/oo (carp, crucian carp, roach, tench, orfe, pike, perch, burbot); Group II includes fishes capable of withstanding salinities up to 20 °/oo (whitefishes, trout, salmon, threespine stickleback, eel). Salinity tolerance in all these fishes appears in later stages of development; larval fishes survive in water with not more than 7 °/oo salinity. The fishes studied have various salt concentrations in their blood plasma, the concentrations in fishes of Group II (diadromous) being higher, approaching those of marine fishes. Blood osmotic pressure was studied at various salinities and was determined from the freezing point of the solution with the aid of a microelectrothermometer. In Group I fish (freshwater) the osmotic pressure was rather small, but even a slight increase in salinity caused an increase in blood plasma salts and death. In Group II specimens blood osmotic pressure rises only when the salinity exceeds 10 °/oo. A direct relationship exists between the salt tolerance of a fish and the blood plasma Δ: the higher the blood plasma Δ, the higher the fishes' tolerance to the salinity of the external medium. In freshwater fishes the blood plasma Δ does not exceed 0.500-0.550; in migratory fishes it does not exceed 0.600. A fish's tolerance for an increase of salinity can be determined from the blood plasma Δ. In freshwater fishes, salts from the external medium enter the organism through the gills and skin, as well as with the food; the bulk of the salts is excreted through the kidneys with the urine and through the intestines along with unassimilated food remains. Acclimation of fishes to increased salinity as shown by experiments involving adaptation to gradually rising salt content, was found to be extremely restricted: the lethal salinity limit increased only by 3-5 °/oo.

8996. Privol'nev, T.I., Z.I. Galkina, and G.G. Galkin. 1964. EFFECT OF THE SIZE OF SALMON FEMALES AND THE SIZE OF THEIR EGGS ON THE OFFSPRING. Izv Gos Nauch-Issled Inst Ozern Rechn Khoz 58: 159-166. (Engl. summ.). From: Ref Zh Biol, 1965, No. 18I25. (Translation); Biological Abstracts, 48(3): Abst. No. 11215. 1967.

Experiments on the rearing of salmon young from dissimilar eggs were conducted at the Narva fish hatchery from October 1953 to September 1954. Observations were made on young from large and small eggs from females of medium size and weight, and also from eggs of the same average size from females of different size and age. Incubation of experimental egg batches and development of young proceeded under similar conditions. Embryonic development was studied on fixed materials. In all, 112 samples of 30 specimens each were examined. Comparative data on development during the embryonic and postembryonic periods are presented. No substantial differences were established between the development of embryos and young from different females and from eggs of different sizes. Commencement of active feeding of young, complete yolk absorption, and development of morphological features proceeded almost simultaneously and at similar sizes. Embryos from larger eggs were found to have a greater amount of yolk; however, the differences were smoothed out toward the end of yolk absorption. Young obtained from large females tended to grow faster than those obtained from small females. Thus, at 81 days after hatching, the lengths and weights of the young were, respectively, to 39.2 and 35.6 mm, 660 and 470 mg.

8997. Sukhoi Van, P.G. 1959. EXPERIMENT IN THE USE OF ARTIFICIAL SPAWNING GROUNDS DOWNSTREAM FROM THE KAKHOVKA HYDRO-ELECTRIC STATION. Rybn. Khoz. 3. 28-31; Ref Zh Biol, 1960, No. 11125. (Translation); Biological Abstracts, 48(3): Abst. No. 11229. 1967.

Artificial spawning grounds were experimentally set up in the Dnieper River, downstream from the dam-wall of the Kakhovka hydro-electric station. Artificial nests were built with a substratum of forked roots of various plants. Eggs were laid on 90% of the nests, mostly by the Azov roach (Rutilus rutilus heckeli). The quantity of eggs of pike-perch and bream was insignificant. On some nests pike-perch and Azov roach, pike-perch and bream, Azov roach and bream, spawned together. It was calculated that approximately 150 kg of eggs were laid on 355 nests, which would amount to approximately 55 million eggs. In comparison with natural spawning grounds, there is less waste of eggs on artificial spawning grounds. During incubation, average mortality of eggs was: pike-perch 3.1%, Azov roach 5.7%, and bream 12.4%. --Courtesy NSF (PL 83-480) 1963.

8998. Ursin, Erik. 1965. ON THE INCORPORATION OF TEMPERATURE IN THE VON BERTALANFFY GROWTH EQUATION. Meddeleiser Danmarks Fiskeri Og Havundersogelser 4(1/7): 1-16. Illus.; Biological Abstracts, 48(3): Abst. No. 11238. 1967.

On the assumption that development time varies with temperature as a catenary curve (Janisch, von Bertalanffy) it is shown that seasonal growth variation due to temperature may be eliminated from a growth curve by plotting length against time as a function of temperature. The function and simple approximations are specified. The method is a development of a procedure used by I. Boëtius (1962) who plotted length against "day degrees". The coefficients of anabolism, E, and catabolism, K, of the von Bertalanffy growth equation are fitted to catenary curves and it is shown that the ensuing variation of asymptotic length, L_{oo}, with temperature is not quite simple. It depends on the temperature at which each of the 2 groups of processes (anabolic and catabolic) involved in growth pass off at maximum speed. It also depends on the temperature coefficient of each of these 2 groups of processes. (Auth.)

8999. Mepham, T.B., and M.W. Smith (Agr. Res. Council, Inst. Animal Physiol., Babraham, Cambridge, England). 1966. AMINO ACID TRANSPORT IN THE GOLDFISH INTESTINE. J. Physiol. (London), 184(3): 673-684. Illus.; Biological Abstracts, 48(3): Abst. No. 11857. 1967.

The serosal transfer of the following 8 amino acids: threonine, alanine, serine, histidine, valine, methionine, phenylalanine and leucine, was measured using everted sacs of anterior intestine taken from goldfish acclimatized to 8° C and incubated at 25° C. All 8 amino acids were actively transported and the serosal transfer correlated with the steady potential ($P<0.001$) and with the amino acid-evoked potential ($P<0.05$) measured on the same preparations. The goldfish rectum actively transported alanine and the steady potential was raised when alanine bathed the mucosa of the everted preparation. L-aspartic acid was partly transaminated to alanine by the goldfish anterior intestine; the rectum transaminated alanine to an unidentified amino acid which might have been serine, asparagine or glutamine or some mixture of these three. It is suggested that L-amino acids increase the ease by which Na enters the muscosal cell but that it is the rate at which this Na is transported across the basal membrane which determines the net serosal transfer of amino acids. (Authors)

9000. Neustroev, G.V., and V.N. Podymakhin (Polar Res. Inst. Fish. Ind. Oceanogr., Murmansk, USSR). 1966. DEVELOPMENTAL RATE OF ATLANTIC SALMON (Salmo salar) EGGS WHEN THERE IS RADIOACTIVE CONTAMINATION OF THE WATER BY $Sr^{90} + Y^{90}$. Radiobiologiya 6(2): 321-323. Illus.; Biological Abstracts, 48(3): Abst. No. 13718. 1967.

From 1963-64 studies were made of the development of Atlantic salmon (Salmo salar) eggs in aquariums contaminated with the radioisotopes $Sr^{90} + Y^{90}$. Data show that in the aquariums contaminated by $Sr^{90} + Y^{90}$ at 10^{-10} curies/l the

rate of development of the eggs was greater than that of the control aquarium. The percentage of eggs that died in the incubation period and the number of deformed eggs in the contaminated aquarium (10^{-10} curies/l) did not exceed the same indices noted in the control aquarium. The rate of development in the aquariums contaminated by Sr^{90} + Y^{90} at concentrations of 10^{-6} and 10^{-8} curies/l was the same as that in the aquarium contaminated by Sr^{90} + Y^{90} at 10^{-10} curies/l (according to the individual stages). However, the mortality percentage and the number of deformities were greater in the aquariums having a higher level of radioactivity. --A. Fast.

9001. Summerfelt, Robert C. (Dept. Zool., Kansas State Univ., Manhattan, Kansas). 1966. IDENTIFICATION OF A FISH SERUM PROTEIN WITH ANTIBODY ACTIVITY. Wildlife Dis. Ass. Bull. 2(2): 23-30. Illus.; Biological Abstracts, 48(3): Abst. No. 14067. 1967.

The golden shiner, Notemigonus crysoleucas, developed antibody titer of 1,280 in 59 days from multiple, intraperitoneal injections of a formalin-killed bacterin of Aeromonas liquefaciens. After 4 immunizing injections there was a significant increase in the time of survival of vaccinated fish over nonvaccinated fish challenged with viable A. liquefaciens. Analysis of golden shiner sera by paper electrophoresis produced a pattern of 6 protein components. Antibody activity was associated with a component which had a slow anodic electrophoretic mobility and solubility of gamma globulin. During the course of vaccination, increments in the serum protein component and in antibody titer coincided. Also, the amount of the protein component of vaccinated fish was decreased by specific adsorption of antibody by homologous antigen. Thus, a fish immunoglobulin was identified which had certain physical and chemical properties corresponding to classical definitions of gamma globulin. (Auth.)

9002. Harrison, A. D., and E. A. Rattray (Dept. Zool., Univ. Natal, Pietermaritzburg, South Africa). 1966. BIOLOGICAL EFFECTS OF MOLLUSCICIDING NATURAL WATERS. In: Limnological Society of Southern Africa Symposium on Bilharzia, July 1965. South African Jour. Sci., 62(7): 238-241; Biological Abstracts, 48(3): Abst. No. 14463. 1967.

The 2 methods of molluscicidng reported here, blanket treatment with surveillance and low-concentration drip feeding, both show distinct promise, especially with Bayluscid (Bayer 73) and Shell WL 8008 (N-tritylmorpholine), the 2 molluscicides in use in Rhodesia. Schistosome host snails are controlled and there is less effect on the general fauna than appeared originally. Fish and tadpoles are eliminated during blanket treatment with both molluscicides but return to normal densities in streams under surveillance. The rest of the fauna is little affected, including the predatory arthropods. (From auth.)

9003. Izyumov, N. A. 1959. THE FORMATION OF THE PARASITIC FAUNA OF FISH IN THE RYBINSK RESERVOIR. Byul. Inst. Biol. Vodokhran. Akad. Nauk SSSR 4. 38-40; From: Ref. Zh. Biol., 1960, No. 56147. (Translation); Biological Abstracts, 48(3): Abst. No. 15411. 1967.

The changes in the parasitic fauna of fish in the Rybinsk reservoir were observed over the past 8-9 years. Some previously prevalent parasites (Bucephalus polymorphus, Phyllodistomum folium) have become scarce. Other parasites Myxobolus volgensis, Phyllodistomum angulatum, Tetracotyle variegata), previously scarce, are now abundantly present. Henneguya oviperda, a specific parasite of female pike gonads, is reported for the first time in the reservoir. The formation of the parasitic fauna of fish lags behind the general process of fauna formation in the reservoir because of the intricacy of relationships between parasites and their intermediate and final hosts. --Courtesy NSF (PL 83-480) 1963.

9004. Rasheed, Suraiya (Mount Vernon Hospital, Northwood, Middlesex, England). 1965. OBSERVATIONS ON THE SPIRUROID NEMATODES OF FISH WITH A REVISION OF THE GENUS Metabronema Yorke and Maplestone, 1926. Z. Zool. Syst. Evolutionsforsch 3(3/4): 359-387. Illus. (Ger. summ.); Biological Abstracts, 48(3): Abst. No. 15493. 1967.

The Spiruroid genera of fish have been reviewed in this paper. Particular emphasis is placed on the genus Metabronema Yorke and Maplestone, 1926, which is regarded as distinct from Cystidicoloides Skinker, 1931. In the latter all the species except the type species (i. e. M. magnum, Taylor, 1925) have been amended and the genus Sterliadochona Skrjabin, 1946, is considered as its synonym. The genera Ichthyobronema Gnedina and Ssavina, 1930, Cottocomephoronema Layman, 1933, and Comephoronema Layman, 1933, are regarded as genera incertae sedis. All the related genera in each case are discussed. Ascarophis ochracea is described from the type specimens of Linstow (1894). (Auth.)

9005. Lopukhina, A. M. (Res. Inst. Lake River Fish. Manage., Leningrad, USSR). 1966. THE STATE OF GLYCOGEN STORE IN THE LIVER OF FISH INFECTED WITH PLEROCERCOIDS Triaenophorus nodulosus (Cestoda Pseudophyllidea). Zool. Zh., 45(5): 702-705. (Engl. summ.); Biological Abstracts, 48(4): Abst. No. 15830. 1967.

The state of glycogen store in the liver of the rainbow trout, Lagoda smelt and perch was studied histochemically and biochemically. Glycogen was found to be evenly distributed in all parenchimal cells. Its amount did not decrease when the liver was infected with plerocercoids T. nodulosus. (Auth.)

9006. Gerasimov, V. V. 1965. THE ROLE OF IMITATION REFLEXES IN THE SCHOOLING BEHAVIOR OF SEA FISHES. In: Biological significance and functional determination of animal migratory behavior). Nauka: Moscow-Leningrad. 53-59. From: Ref Zh Biol, 1965, No. 24I51. (Translation); Biological Abstracts, 48(4): Abst. No. 16021. 1967.

In cod and coalfish individuals of the same size the unconditioned imitation reflex appeared with the first combination; haddock required several reinforcements. The absence of unconditioned mimickry was noted in individuals of the same and different size groups but of different species, as well as in the non-schooling eelpout and gobies. The experiments indicate the possibility of forming conditioned imitation reflexes in various numbers (2-9) of imitating fishes in the presence of one "working" fish. Imitation was effected through motor defensive reactions of the "working" fish. Light and sound were employed as conditioning stimuli, while electric current served as unconditioned reinforcement.

9007. Nishiyama, Tsuneo. (Fac. Fish., Hokkaido Univ., Hokkaido, Japan). 1965. A PRELIMINARY NOTE ON THE EFFECT OF HYDROSTATIC PRESSURE ON THE BEHAVIOR OF SOME FISH. Bull. Fac. Fish. Hokkaido Univ. 15(4): 213-214; Biological Abstracts, 48(4): Abst. No. 16034. 1967.

A brief explanation of the tank apparatus used to raise or lower hydrostatic pressure in fish is presented along with a preliminary description of the resulting abnormal changes in posture, body color, and respiratory rhythm.

9008. McDonald, D. B., and A. R. Gaufin (Univ. Iowa, Iowa City, Iowa). 1966. MODIFICATION OF ALGAL CONTROL PROCEDURES TO PREVENT FISH KILLS IN MULTIPLE USE IMPOUNDMENTS. Proc. Utah Acad. Sci. Arts Lett. 42(2): 201-202; Biological Abstracts, 48(4): Abst. No. 16178. 1967.

The use of copper sulfate as an algacide does not harm fish or materially reduce fishing success, provided the chemical is applied uniformly in concentrations of 1 ppm to areas of open water. Uneven application of copper sulfate, especially in areas of shallow water, may result in damage to the fishery and may actually increase taste and odor problems due to the death and subsequent decay of large numbers of fish. (Authors)

9009. Bobrova, Yu. P. 1965. EXPERIMENTAL REARING OF 2- AND 3-SUMMER GRASS CARP IN ASSOCIATION WITH 2-SUMMER CARP IN THE MOSCOW REGION. Tr. Vseros Nauch-Issled Inst. Prudovogo Rybn Khoz. 13: 41-45. From: Ref Zh Biol, 1965, No. 22194. (Translation); Biological Abstracts, 48(4): Abst. No. 16190. 1967.

Growth rate and maturation of grass carp were studied in 1963 in the fish

hatchery "Yakot" under various conditions. Combined rearing of 2- and 3-summer grass carp with 2-summer carp was carried cut in ponds with an area of 0.1 ha. Grass carp were stocked at the rate of 1000 to 500 specimens per hectare, while the stocking rate of carp viried from 500 to 1500 specimens. Grass carp exhibited some selectivity with respect to food, consuming duckweed and manna grass at first, and other plant species later. Several cases have been noted of the consumption by grass carp of mixed feed given to carp. By the end of the season, 2-summer grass carp in various ponds averaged 293-364 g (maximum up to 800 g), and 3-summer grass carp 476-570 g (to 954 g). Combined rearing of grass carp with carp significantly lowered food consumption and raised the fish productivity of the ponds to 65% without addition of food concentrates.

9010. Kafanova, V. V. 1965. CONTRIBUTION TO THE STUDY OF THE GRAYLING OF LAKE NIZHNEE KULAGASH-BAZHI (CHULYSHMAN RIVER BASIN). Izv Altaiskogo Otd Geogr Obshchest SSSR 5. 165. From: Ref Zh Biol, 1965, No. 22116. (Translation); Biological Abstracts, 48(4): Abst. No. 16208. 1967.

Lake Kulagash-Bazhi is inhabited only by grayling, which are immediately distinguished from grayling of other bodies of water by the bright orange color of the caudal peduncle and fins. Fish averaging 200 mm in length had an average weight of 254 g.

9011. Koroleva, N. V. 1964. ALBUMEN CONTENT OF THE BLOOD SERUM OF RAINBOW TROUT. Izv Gos Nauch-Issled Inst Ozern Rechn Rybn Khoz 58: 109-116. (Engl. summ.). From: Ref Zh Biol, 1965, No. 22I72. (Translation); Biological Abstracts, 48(4): Abst. No. 16216. 1967.

Total blood serum albumen was determined by means of a refractometer, and was found to increase with age. In 2-month-old individuals it was 3.5%; in yearlings, 7-8%. By the end of the fattening up period in November the protein content in yearlings was 6.5%, dropping to 5% by spring. The lowest protein content was recorded for trout receiving spleen (50%), fodder yeast (40%) and oatmeal (10%). The highest protein content was observed in trout fed a ration consisting of spleen (50%), bone meal (25%), fodder yeast (20%) and oatmeal (5%).

9012. Kozhin, N. I. 1965. THEORETICAL BASES OF ARTIFICIAL FISH CULTURE. In: Theoretical bases of fish culture). Nauka: Moscow. 85-91. From: Ref Zh Biol, 1965, No. 22I79. (Translation); Biological Abstracts, 48(4): Abst. No. 16218. 1967.

Artificial fish culture became possible after the discovery by Jacoby in 1763 of the wet method, and by Vrasskiy in 1854 of the dry method, of egg fertilization. In artificial culture by the dry method egg fertilization is almost complete, and egg survival and the numbers of hatched larvae are high. It was thought that fish stocks could be replenished by large-scale fish-rearing operations, and natural reproduction was regarded as inadequate; hatchery production concerned itself mainly with fertilized eggs and larvae. Subsequent research has shown that the highest losses occurred not in the embryonic, but in the postembryonic period, which indicates the necessity of rearing artificially produced young fishes in ponds. A fish classification according to the structure of their spawning populations, suggested by Monastyrsky, permits a review of the effectiveness of fish-rearing operations. Artificial fish culture can wholly replace natural fish culture only in spawning stocks that have a simple structure and consist of recruitment only (Pacific salmon), or in stocks in which the number of second-time spawners is very small (Atlantic salmon, whitefish). In a complex spawning population (sturgeons), where second-time spawners play a dominant role, it is essential to combine artificial with natural propagation. Complete change-over to artificial propagation will lead to cessation of second-time spawning, which is bound to result in the fishery being transferred to less productive first-time spawners.

9013. Saddler, James B. (Dept. Fish. and Wildlife, Oregon State Univ., Corvallis, Oregon). 1966. DISTRIBUTION AND IDENTIFICATION OF THE FATTY ACIDS FROM THE COHO SALMON, Oncorhynchus kisutch (Walbaum). Jour. Amer. Oil

Chem Soc 43(5): 321-324. Illus.; Biological Abstracts, 48(4): Abst. No. 16370. 1967.

To study the fatty acids of the coho salmon, entire fish were homogenized and the total lipids extracted with methanol-chloroform. The fish ranged in size from 75 to 85 mm total length and contained from 2.1% - 6.9% lipid in the tissues. Methyl esters of the fatty acids were produced with anhydrous methanol and HCl. Qualitative identification of the fatty acid methyl esters was accomplished by gas-liquid chromatography. Thin layer silver nitrate-silicic acid plates were used to separate the componeent methyl esters according to the number of double bonds. Location of the ethylenic groups of the unsaturated fatty acid methyl esters was established by reductive ozonolysis and identification of the aldehydes and aldehyde-esters produced. The number of carbons in the unsaturated fatty acid methyl esters was determined by hydrogenation of each of the fractions. Fatty acids found in the highest concentrations were: 16:0, 16:1, 18:0, 18:1, 18:4, and 22:6. Fatty acids 16:0, 18:1, 18:2, 20:5, and 22:6, differed markedly from concentrations found in tubificid worms, the exclusive diet of the fish during the experiment. (Authors)

9014. Lebedev, N. V., B. M. Logvinenko, E. V. Fadeev, and Z. I. Arkhipova (M. V. Lomonosov State Univ., Moscow, USSR). 1966. MOTOR RESPONSES OF KERCH SHAD TO ACOUSTIC VIBRATIONS. Biol. Nauk. 9(3): 118-119; Biological Abstracts, 48(4): Abst. No. 17524. 1967.

Results are presented of an investigation of the effect of sound on the Kerch shad (Alosa brashnikovi maeotica). The fishes were divided into 2 groups, those 10-14 cm long and those 16-22 cm long. The fishes were exposed to audio frequencies of 3, 6.4, and 12.7 cps. A comparison of the reactions of the investigated fishes showed that the small shad (10-14 cm) reacted more weakly than the large shad (16-22 cm). This was judged both by the number of fishes that reacted and by the average and maximal coefficients of reaction at all the indicated frequencies. The maximal reaction in both size groups was obtained at a frequency of 6.4 cps. The motor reactions of the Kerch shad to acoustic vibrations were quite distinctly expressed, therefore it is concluded that this effect can be used for practical purposes. The obtained data on the motor reactions to acoustic vibrations of comparatively high audio frequencies of the Kerch shad permit the assumption of the presence of similar reactions in other species of the shad family. --J. Slep.

9015. Bauer, O. N. 1958. INTERRELATIONSHIP BETWEEN PARASITES AND HOSTS (FISHES). In: Basic problems of parasitology of fish. Leningradsk. Gos. Univ.: Leningrad. 90-108, 338; Ref. Zh. Biol, 1959, No. 52506. (Translation). (German summ.); Biological Abstracts, 48(4): Abst. No. 20070. 1967.

This study concerns the effect of parasites and the reaction of fish to parasites. The effect of parasites may be mechanical or toxic. Parasites may carry other parasites or infections. Many parasites slow down the growth rate of fish, damage its condition, and decrease the quantity of fish by killing individuals and damaging the reproductive system. The fish reacts to the parasites by proliferous growth of tissue and the formation of cysts (which localize the parasites), inflammatory processes, regeneration, and acquisition of superinfective immunity. Certain cases of immunity developed under the influence of Ichthyophthirius, monogenetic and digenetic trematodes and cestodes. It is noted that the immunity of fish infested with parasites has hardly been studied. --Courtesy NSF (PL 83-480) 1963.

9016. Doenges, Johannes (Tropenmed. Inst. Univ. Tubingen, Tubingen, West Germany). 1965. THE BLACK SPOT DISEASES IN FISHES: UNRAVELING OF THE DEVELOPMENTAL CYCLE OF THE CAUSATIVE AGENT AFTER 130 YEARS. Umschav Wiss Tech 65(8): 235-239. Illus. Portrait; Biological Abstracts, 48(4): Abst. No. 20074. 1967.

The trematode Posthodiplostomum culticola was recognized as the causative agent of the black spot disease in fishes in 1832. But its developmental cycle has been unraveled only recently. The 1st hosts of the trematode larvae are 2 related

species of water snails Tropidiscus planorbis and T. carinatus. Fishes are 2nd hosts of these parasites. Phoxinus laevis, Squalius cephalus and Scardinius erythrophthalmus are especially susceptible. The behavior of the cercariae, their development in fishes and disease symptoms of fishes, their development in the host Ardea cinerea, the miracidium, the 2nd free living larval form and its development in the snail are described. Several such cycles have been reproduced in the laboratory within a span of 98 days under favorable temperatures. The main growth stadium of the parasite takes place in the fish. The developmental step from the cercaria to the metacercaria is much greater than the next one to the mature worm. --R. Kroha.

9017. Fried, Bernard, James G. Kitchen, and Richard S. Koplin (Lafayette Coll., Easton, Penn.). 1965. AN INTESTINAL HELMINTH STUDY OF Catostomus commersoni FROM THE BUSHKILL CREEK, NORTHAMPTON COUNTY, PENNSYLVANIA WITH OBSERVATIONS ON SEASONAL DISTRIBUTION OF Triganodistomum SP. (Trematoda) AND Fessisentis SP. (Acanthocephala). In: Fortieth Annual Meeting of the Pennsylvania Academy of Science, University Park, 26-28 March, 1964. Proc. Penn. Acad. Sci., 38(2): 95-98; Biological Abstracts, 48(4): Abst. No. 20078. 1967.

Sixty-five (73.9%) of 88 Catostomus commersoni collected from the Bushkill Creek, Northampton County, Pennsylvania in 1963 were infected with 1 or more species of Caryophyllaeidae (Cestoda), Triganodistomum (Trematoda), and Fessisentis (Acanthocephala). The only species positively identified was Triganodistomum attenuatum Mueller and Van Cleave, 1932. Specimens of Triganodistomum were abundant in the spring and sparse in the fall. Fessisentis sp., absent in the spring, was present in the fall. These findings suggest a seasonal distribution of species of Triganoditomum and Fessisentis from C. commersoni from the Bushkill Creek. (Authors)

9018. Hanson, Jack A., and Almo J. Cordone (Calif. Dept. of Fish and Game, Sacramento, Calif.). 1967. AGE AND GROWTH OF LAKE TROUT, Salvelinus namaycush (Walbaum), IN LAKE TAHOE. Calif. Fish and Game, 53(2): 68-87.

Ages of 2,873 lake trout collected at various times between 1938 and 1964 were determined from their scales. The average calculated lengths for ages 1 through 17 are: 4.6, 7.0, 9.9, 12.6, 15.0, 17.0, 18.9, 20.9, 22.8, 24.5, 26.3, 27.7, 28.4, 30.4, 32.4, 33.4, and 35.8 inches, respectively. The fork length-anterior scale radius relationship is described by the formula $Y = 2.33018 + 0.14283X$. Comparison of year classes indicates that growth has been relatively constant for 40 years. Annulus formation occurred from early February to mid-September. Growth continued all year, reaching a maximum between mid-June and the end of September. Growth was slow compared to that in most other large, oligotrophic lakes. The length-weight relationship is described by $W = 3.63591 + 3.17941 \log L$. (Authors)

9019. Pinkas, Leo, James C. Thomas, and Jack A. Hanson (Calif. Dept. of Fish and Game, Terminal Island, Calif.). 1967. MARINE SPORTFISHING SURVEY OF SOUTHERN CALIFORNIA PIERS AND JETTIES, 1963. Calif. Fish and Game, 53(2): 88-104.

In 1962, the California Department of Fish and Game initiated a project to ascertain the magnitude and significance of sportfishing activities from piers, jetties, the shore line, and private vessels in southern California marine waters. The first of this three-phase program was a creel census of sport fishermen on piers and jetties during the calendar year 1963. The census incorporated a probability sampling plan designed to yield estimates of total effort, total numbers of fish caught, and species composition of the catch. We estimate that a minimum of 5.1 million man-hours of fishing was expended in catching 1.86 million fish from southern California marine piers and jetties during the period February through December 1963. Slightly over half of this effort and catch, 54.4 and 50.7%, was expended from May through August. The catch was comprised of 49 species of fishes belonging to 26 family groups, the most significant being croakers,

surfperches, and bonito. Well over 60% of the total activity and catch occurred from piers. We recommend: (1) that the California Wildlife Conservation Board continue its capital outlay program for pier development; (2) that periodic surveys be undertaken to assess sportfishing activities from piers, jetties, the shore line, and private boats along the entire California coast; (3) that life history investigations be initiated for the five most important species of fishes to southern California pier and jetty fishermen; namely, queenfish, white croaker, walleye surfperch, Pacific bonito, and shiner perch. (Authors).

9020. Mount, Donald I., and William A. Brungs (Aquatic Biol. Activities, Basic and Applied Sciences Program, Cincinnati Water Res. Lab., Fed. Water Pollut. Control Admin., Cincinnati, Ohio). 1967. A SIMPLIFIED DOSING APPARATUS FOR FISH TOXICOLOGY STUDIES. Water Research, 1(1): 21-29.

A simplified diluter for maintaining a series of constant concentrations of a material in flowing water is described. It depends on water flows, metering cells, and venturi tubes to proportion volumes of water and toxicant to give desired concentrations. Construction requires less than 2 days, and only readily available materials are needed. An injector for mixing pesticides in water is also described.

9021. Longhurst, Alan R. (Inst. of Marine Resources, Scripps Institution of Oceanography, San Diego, Calif.). 1967. VERTICAL DISTRIBUTION OF ZOOPLANKTON IN RELATION TO THE EASTERN PACIFIC OXYGEN MINIMUM. Deep-Sea Research, 14(1): 51-63.

Data recently obtained in the southern end of the California Current with the use of a new plankton sampler are used to demonstrate the presence of abundant zooplankton in the oxygen minimum of this area, down to oxygen concentrations of 0.2 ml/l. This zooplankton is dominated by resting copepodites of Calanus helgolandicus which are present as rather dense and depth-restricted layers, principally in the oxygen- deficient water below 150 m; also occurring at such depths are several species which perform nocturnal vertical migrations into the California Current water above the oxygen minimum and thus encompass a daily variation in oxygen tension of 0.2-5.0 ml/l. The epiplankton of the California Current is composed of many more taxa than the fauna of the oxygen-deficient layer, including a spectrum of genera typical of warm surface-water plankton; to this epiplankton at night are added the plankters migrating from below, which appear to aggregate rather deeper in the mixed layer than does the epiplankton. It is considered that the difference between the abundant fauna of the oxygen-deficient layer in this region, compared with sparser faunas in other oxygen minima is due to the effects of the local coastal upwelling followed by rapid diatom blooms along the coast of Baja California. (Auth.)

9022. Heinold, George. 1967. THREAT OF THE LONGLINES. Outdoor Life, 139(2): 104, 107, 153.

Description of the system used by commercial fishermen to harvest swordfish, tuna, marlin, sailfish, and albacore. Effectiveness of the longlines is a serious threat to these big-game species. A conference on the longline problem was held in Rio de Janeiro and was attended by delegates from 17 interested nations. It is hoped that the discussions at that meeting will reduce the detrimental commercial harvest of big-game fishes where they are of greatest importance to the sportfishing industry.

9023. Davenport, Arthur. 1967. NEW FISH FOR THE NORTHEAST. Field and Stream, 71(12): 38-39, 106-109.

Kokanee introduction in Connecticut lakes are providing some good fishing. These salmon are now present in lakes in Maine, New York, and Pennsylvania, as well as Connecticut, but the growth and harvest vary considerably.

9024. Templeman, Wilfred. 1966. MARINE RESOURCES OF NEWFOUNDLAND. Fisheries Research Board of Canada, Ottawa, Bulletin No. 154. 170 p.

9025. McClane, A. J. 1967. WHERE EAST MEETS WEST. Field and Stream, 71(12): 78-80, 89-90, 92.

Successful introduction of coho salmon in the Great Lakes has given rise to a new spate of attempts to stock western salmon in eastern waters. The short life of these fish require an abundant food supply in lakes and reservoirs for them to make appreciable growth. The heavy population of alewives now in the Great Lakes is probably responsible for the success of the coho there.

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AUTHOR INDEX

Aasted, Donald C., 8566
Abakumov, V.A., 8475
Abe, Haruzo, 8455
Abrosov, V.N., 8493
Aggus, Larry R., 8374
Akyuz, E.F., 8900
Alckmin, Geraldo Jose R., 8948
Alexander, Gaylord R., 8437
Alexander, R.M., 8730
Alikunhi, K.H., 8390
Allen, George H., 8415, 8677, 8823
Allen, K. Radway, 8796
Allison, Ray, 8536
Allyn, Rube, 8490
Alvord, William, 8487
Amberg, H.R., 8755
Ames, Warren E., 8648
Anderson, J.M., 8464
Anderson, James C., 8562
Anderson, Richard B., 8440
Anderson, William D., Jr., 8548
Anderson, William W., 8336
Andersson, Evert, 8974
Andrew, F.J., 8831
Andrews, Austin K., 8646
Andrews, C.W., 8665
Anonymous, 8365, 8378, 8594, 8657, 8833
Apelgren, Bert, 8589
Apmann, Robert P., 8658
Applegate, Richard L., 8449, 8828
Applegate, Shelton P., 8575
Arendarenko, G.A., 8533
Armbruster, Daniel, 8319
Armstrong, Robert H., 8315, 8316, 8590
Arnold, Dean E., 8882
Astapovich, I.T., 8921
Atherton, Charles R., 8855
Atkins, Buell O., 8502
Atz, James W., 8912
Austin, Herbert, 8484
Autko, B.F., 8919
Avault, James W., Jr., 8536
Awakura, Teruhiko, 8454
Ayres, J.L., 8725
Azbelev, V.V., 8735
Azeta, Masanori, 8457

Bachon, William, 8522
Bakshtanskii, E.L., 8711
Baldwin, E., 8742
Ball, Robert C., 8420, 8442, 8687, 8723
Ballintijn, C.M., 8619
Banner, Albert H., 8944
Baptist, John P., 8438
Barannikova, I.A., 8708
Bass, George A., 8343
Basu, A.K., 8861
Basu, Juthika, 8707
Bauer, O.N., 9015
Bayless, Jack, 8368
Bear, George, 8943
Beatty, D.D., 8688
Beaulieu, Gerard, 8924
Beck, Milton M., 8322
Becker, Clarence D., 8416, 8400, 8446
Becker, David A., 8431
Beeton, Alfred M., 8310
Bellrose, Frank C., 8981
Belova, A.V., 8509
Bennett, Edward B., 8612
Bennett, George W., 8323
Benoit, Raymond F., 8816
Bens, M., 8941
Berczi, I., 8932
Berge, G., 8979
Bergeron, Julien, 8959
Bern, Howard A., 8707
Bernatowicz, Stanislaw, 8983
Berquist, Howard, 8557
Berry, Richard J., 8394
Berst, Alfred H., 8563
Besse, P., 8984
Betts, J.L., 8672
Bhinyoying, Suchit, 8561
Bilinski, E., 8412, 8391
Billy, Thomas J., 8310
Bilton, H.T., 8407, 8789
Bingham, C. Rex, 8650
Bishop, Daniel M., 8393
Biyakarnchana, Twesukdi, 8944
Black, Edgar C., 8302, 8671, 8786, 8797, 8798, 8994
Blackburn, Maurice, 8779
Blackburn, R.D., 8346
Blackett, Roger F., 8590
Blair, A.A., 8468
Blaxter, J.H.S., 8985
Bobrova, Yu. P., 9009
Bodola, Anthony, 8835
Bogdanova, E.A., 8712
Bohun, Sheila, 8868
Boles, Hallett D., 8572
Bonn, Edward W., 8821
Bonner, Rupert R., Jr., 8652
Borgeson, David P., 8572
Bott, Thomas L., 8745
Bouck, Gerald R., 8420, 8442
Bouguet, A., 8471
Bourbon, Ken, 8588
Bowen, J.T., 8632, 8633
Bower, R.E., 8684
Bradford, Arthur D., 8556
Brannon, E.L., 8736
Branson, Branley Allan, 8898
Breder, Charles M., 8975

Breese, Wilbur P., 8820
Brehmer, M. L., 8638
Brett, J. R., 8408, 8450
Brewerton, H. V., 8857
Brooks, John Langdon, 8379
Broughton, John H., 8776
Brown, Bradford E., 8483
Brown, C. J. D., 8942
Brown, Edward H., Jr., 8428
Brungs, William A., 8824, 9020
Brynildson, Oscar M., 8762
Bulloch, David K., 8731
Bullock, G. L., 8501, 8877
Bullock, Wilbur L., 8616
Burck, Wayne A., 8718
Burdick, G. E., 8659
Burmakin, E. V., 8719
Burton, Thomas M., 8726
Busch, Kenneth A., 8538
Buss, Keen, 8402, 8556, 8560, 8621
Butler, Robert L., 8418
Butskaya, N. A., 8537

Cable, Louella E., 8843
Cable, R. M., 8666
Cairns, John, Jr., 8554, 8866, 8968
Calhoun, Alex, 8571
Carlson, Clarence A., 8429
Carlson, Frank T., 8363
Cartier, John O., 8587
Caudill, Harry M., 8977
Chabot, Brian F., 8867
Chakravarti, Diptiman, 8327
Chandler, Garth, 8604
Charig, A. J., 8807
Chapman, C. J., 8680
Chapman, Douglas G., 8529
Chapman, D. W., 8683
Chapman, L. J., 8395
Chaudhuri, H., 8986
Chavin, Walter, 8937, 8980
Cheek, Randall P., 8778
Cherfas, B. I., 8512
Chernyavskaya, I. K., 8713
Chervinski, J., 8535
Čhiař, Jiří, 8689
Childers, William F., 8323
Chipman, Gerald G., 8808
Christenson, Lyle M., 8753
Chuinard, R. G., 8941
Clark, Clarence F., 8428
Clark, John R., 8484, 8643
Clarke, L. W., 8799, 8801
Clemens, Howard P., 8561
Clendenning, K. A., 8701
Coble, Daniel W., 8853
Colborn, Leon G., 8607
Colby, David, 8659
Cole, Charles F., 8434
Colgrove, G. S., 8842
Collar, J. D., 8473
Collins, Eleanor, 8965
Conference of Biological Editors, Committee on Form and Style, 8347
Conder, John, 8384
Conrad, John F., 8768
Conte, F. P., 8469, 8504, 8940
Cooper, A. C., 8841
Cooper, Edwin L., 8668
Cooper, Richard A., 8641
Cope, Oliver B., 8441
Copeland, B. J., 8311, 8312
Cordone, Almo J., 8758, 9018
Coriell, Lewis L., 8951
Corl, Kenneth G., 8560
Cory, Robert P., 8970
Cottam, Clarence, 8926
Cowell, Bruce C., 8421
Cox, William S., 8647
Crance, Johnie H., 8764
Crane, John W., 8474
Cross, Frank B., 8969
Crossman, E. J., 8307, 8402
Crowe, Walter R., 8358
Cumming, Kenneth B., 8324

Dahlberg, Michael L., 8427
Damurat, Jerzy, 8693
Daniels, Stacy L., 8310
Darkov, A. A., 8966
Davenport, Arthur, 9023
Davenport, D., 8403
David, P. M., 8524
Davidson, T. M., 8611
Davis, D. E., 8345
Davis, Robert M., 8818
Dean, H. J., 8659
De Azevedo, Pedro, 8948
Decew, Mark, 8768
Decker, Laurence F., 8576
Deeva, T. A., 8754
Deffner, Janet S., 8745
de Graaf, F., 8519
Degurse, Paul E., 8762
Deibert, Irv, 8304
De Kinkelin, P., 8984
Della Croce, Norberto, 8696
Deuel, David G., 8643
Di Capua, Richard A., 8781
Dickie, L. M., 8465, 8673, 8787
Differ, William R., 8581
Dilworth, Carole L., 8800
Dobie, John, 8847
Dodson, Stanley I., 8379
Doenges, Johannes, 9016
Domurat, Jerzy, 8917
Dönges, Johannes, 8913
Dorofeeva, E. A., 8727, 8936
Dorris, Troy C., 8581
Doudoroff, Peter, 8430

Douglas, John, 8432
Douglas, Neil H., 8726
Dragovich, Alexander, 8829
Drummond, Robert A., 8424, 8606
Dryer, William R., 8396, 8642
Dumas, Richard F., 8318
Dunbar, Clarence E., 8331, 8501, 8508
DuPree, Harry K., 8908
Dyk, Vaclav, 8518, 8702

Eales, J.G., 8451, 8800
Ebert, Earl E., 8370
Edmunds, Philip H., 8439
Edwards, R.W., 8933
Egan, H., 8933
Eggler, Tom, 8892
Egglishaw, H.J., 8860
Eglite, R.M., 8703
Ehira, Shigeo, 8457
Eipper, Alfred W., 8663
Eisler, Ronald, 8439
Eklund, Henning, 8377
Ellis, Derek V., 8411
Elson, P.F., 8388, 8366
Emery, K.O., 8685
Engashev, V.G., 8709
Engebrecht, R.H., 8725
Enger, Per S., 8963
Eppley, Richard W., 8399
Ergens, Radim, 8914
Everhart, W. Harry, 8440, 8425
Ewing, W.H., 8858

Fadeev, E.V., 9014
Fahlen, G., 8479
Faisst, E., 8499
Falck, B., 8479
Falkner, Neil Ward, 8784
FAO Fisheries Division, 8339
Ferguson, Denzel E., 8650, 8806
Fessler, James L., 8564, 8940
Finnell, Larry, 8698
Finucane, John H., 8728
Fish, G.R., 8856, 8987
Fisher, Kenneth C., 8330
Fisk, Donald M., 8443
Flemer, David A., 8653
Foerster, R.E., 8409
Follis, Billy J., 8821
Forney, John L., 8662, 8663
Foster, E.M., 8745
Fowler, Laurie G., 8553
Fox, Denis L., 8382
Francois, Donald, 8591
Frank, G.H., 8859
Frank, Stanislav, 8689
Frantz, Ted C., 8758
French, Robert R., 8834
Fried, Bernard, 9017
Fridberg, Gunnar, 8782
Friend, Albert G., 8538
Frolenko, L.A., 8714
Fromm, P.O., 8405, 8496, 8717, 8929
Frost, Winifred E., 8520
Fry, Donald H., Jr., 8803
Fujino, Kazuo, 8305
Funderburk, H.H., Jr., 8345
Furst, Magnus, 8353
Furukawa, Takeichi, 8500

Galbraith, Merle G., Jr., 8817
Galbreath, James L., 8886
Galkin, G.G., 8996
Galkina, Z.I., 8996
Gammon, James R., 8976
Garside, E.T., 8785, 8795
Gaufin, Arden R., 8491, 9008
Gaufin, Richard F., 8491
Gaylord, William E., 8600
Gebhardt, Gary A., 8329
Geen, G.H., 8802, 8831
Gehringer, Jack W., 8336
Gerasimov, V.V., 9006
Ghittino, Pietro, 8988
Gibson, R. John, 8676
Gilderhus, Philip A., 8645
Gill, Charles D., 8443
Gillaspie, Charles C., 8772
Giudice, John J., 8558
Given, Robert R., 8370
Gloor, U., 8911
Gnose, C., 8940
Gorbman, Aubrey, 8376, 8521, 8946
Gordeeva-Pertseva, L.I., 8510
Gordon, R.W., 8832
Gorman, T.B., 8865
Gosheva, T.D., 8902
Goswami, Shashi V., 8783
Gould, William R., 8935
Govardovskii, V.I., 8922
Grachev, L.G., 8947
Grande, Magne, 8826
Green, O.L., 8567
Greenhood, Edward C., 8704
Greze, V.N., 8737
Grimås, Ulf, 8350
Grimes, Patricia, 8965
Groot, C., 8397
Gross, W.L., 8405
Guichard, F., 8471
Guillon, J.C., 8984

Hale, John G., 8845
Hallock, Richard J., 8803
Halsband, E., 8354
Halsband, I., 8354
Halver, John E., 8629, 8965, 8964
Hane, Satoshi, 8907
Hansen, Donald V., 8889
Hanson, Jack A., 9018, 9019

Hanson, Lee H., 8864
Hara, Toshiaki J., 8376
Hardy, J. L., 8982
Harling, W. R., 8403
Harms, Clarence E., 8480
Harrington, Robert W., Jr., 8830
Harris, E. J., 8659
Harrison, A. D., 9002
Hartman, G. F., 8398, 8802
Hashimoti, Tokoro, 8954
Hasler, Arthur D., 8303, 8584, 8808
Hawkins, A. D., 8680
Hayashi, Koichiro, 8458, 8459, 8671
Hayes, Jim, 8383
Heard, Robert G., 8431
Heath, Alan G., 8906
Hedgpeth, Joel W., 8870
Heiligenberg, Walter, 8539
Heimstra, Norman W., 8514
Heingold, George, 9022
Heiser, David W., 8844
Helfrich, Philip, 8944
Helle, John H., 8445
Henderson, Corswell R., 8538, 8640
Henderson, H. Francis, 8808
Henegar, Dale L., 8596
Henzen, M. R., 8636
Hergenrader, Gary L., 8303
Hess, Nancy E., 8968
Hester, F. Eugene, 8644
Hibbert, Delvan D., 8691
Hickling, C. F., 8927
Higashi, Hideo, 8971
Higham, Joseph R., Jr., 8766
Hile, Ralph, 8603
Hiltibran, Robert C., 8349, 8513, 8749
Hirayama, Kazutsugu, 8525
Hirschhorn, George, 8433
Hochachka, P. W., 8928
Hoese, H. D., 8312
Hoffarth, Ray, 8384
Hoffert, J. Russell, 8929
Hoffman, G. L., 8321, 8331, 8508, 8583
Hohn, Matthew H., 8578
Holden, A. N., 8494
Holland, G. A., 8332
Holmes, Perry Don, 8431
Holmes, W. N., 8620
Hooper, Frank F., 8610
Hopkins, C. L., 8342, 8857
Horton, Donald B., 8394
Houde, Edward D., 8819
Hourston, A. S., 8332
Houston, A. H., 8784
Howell, John H., 8864
Howells, W. Roscoe, 8340
Hruška, Václav, 8689
Huber, Richard T., 8896
Hughes, G. M., 8619
Hunn, Joseph B., 8869
Hunt, George S., 8854
Hunt, Robert L., 8609
Hunter, John R., 8566
Huntsman, A. G., 8738
Hurley, Donal A., 8330

Ikematsu, Wataru, 8457
Ingle, David J., 8375
Isaacson, Peter A., 8570
Isaev, A. I., 8739
Ishii, Seinosuke, 8971
Ivanova, L. D., 8512
Izyumov, N. A., 9003

Jackson, K. J., 8850
Jäger, Herbert K., 8814
Jahn, Lawrence A., 8791
Jenkinson, D. W., 8678
Jensen, Albert C., 8720, 8822
Jensen, Rue, 8495
Johannes, R. E., 8380
Johnson, C. L., 8462, 8629, 8793, 8794
Johnson, Murray G., 8419
Johnson, W. C., 8573
Johnston, Kenneth H., 8367
Johnston, Norm, 8338
Jonas, R. E. E., 8412, 8391
Jones, Benjamin F., 8649
Jones, Robert S., 8312
Jones, Rodney, 8664
Jordan, Romulo, 8757
Joseph, James, 8461
Julin, Arnold M., 8628
Junge, Charles O., 8885

Kafanova, V. V., 9010
Kamata, Tokiro, 8458, 8459
Kamenskii, I. V., 8547
Kamoto, Mitsurusa, 8690
Kanda, Kazuo, 8500
Kaneko, Tokugoro, 8971
Kassner, Jerzy, 8530, 8744
Katz, Max, 8400, 8416, 8446
Kawamura, Teruyoshi, 8694
Kawashima, Rihei, 8989
Kawatsu, Hiroshi, 8585
Kearn, G. C., 8682
Keenleyside, Miles H. A., 8676
Keller, Myrl, 8920
Kelley, D. W., 8873
Kelly, William H., 8660
Kempe, Lloyd L., 8310
Kent, Fred, 8610
Kerharo, J., 8471
Kern, Cal, 8622
Kerswill, C. J., 8366
Kevern, N. R., 8810
Khalturin, D. K., 8958
Kikuchi, Shiro, 8455
Kilarski, Wincenty, 8706

King, Dennis R., 8854
King, Everett L., Jr., 8864
Kinney, Edward C., 8355
Kirkpatrick, Donald, 8786, 8797, 8798
Kisaburo, Taguchi, 8373
Kitaev, S.P., 8901, 8916
Kitchen, James G., 9017
Klein, W.D., 8559, 8651, 8698
Kleinert, Stanton J., 8899
Klement, Alfred W., Jr., 8356
Knapp, Stuart E., 8329
Knipprath, Werner G., 8747
Kobayasi, Hiromu, 8482
Kobayashi, Shigeo, 8458, 8459
Koehn, Richard K., 8724
Kok, L.T., 8973
Kolbe, F.F., 8636
Koplin, Richard S., 9017
Korobchenko, L.A., 8921
Koroleva, N.V., 9011
Korovina, V.M., 8936
Kosyreva, R. Ya., 8512
Kozhin, N.I., 9012
Kramer, Robert H., 8320, 8426, 8436, 8543
Kruger, Lawrence, 8544
Krupp, Marcus A., 8907
Krykhtim, M.L., 8476
Kuchnow, Karl P., 8382
Kume, Susumu, 8461, 8613
Kumpf, Herman E., 8732
Kupka, K.H., 8849
Kurahashi, Sumio, 8455, 8456
Kwain, Wen-Hwa, 8675
Kyuûshin, Ken-Ichirô, 8989

Lackey, James B., 8701
Ladiges, Werner, 8489
Lagunov, I.I., 8735
Lahav, M., 8546
Lambou, Victor, W., 8423
Lander, Robert H., 8470
Lane, Robert K., 8721
Lanzing, W. J. R., 8863
Lapin, Yu. E., 8477
Larkin, P.A., 8741, 8994
La Roche, Gilles, 8462, 8629
Larson, Edward, 8545
Lauer, Gerald J., 8647
Lavrovskii, V., 8478
Lawler, G.H., 8404, 8401
Lawrence, J.M., 8345
Learner, M.A., 8933
Lebedev, N.V., 9014
Leduc, Gerard, 8430
LeGuen, J.C., 8542
Leman, Bernie, 8813
Lennon, Robert E., 8699
Leonard, Justin W., 8978
Leopold, A. Starker, 8978
Levaditi, J.C., 8984
Levan, Albert, 8951
Lewis, J.C., 8743
Lewis, Robert M., 8652
Libosvarsky, Jiri, 8722
Lindroth, Arne, 8655
Lindsay, Raymond H., 8908
Lindsey, C.C., 8802
Lindsey, James J., 8894
Linton, Kenneth J., 8723
Linton, Thomas L., 8710
Lister, D.B., 8848
Livingston, Donald L., 8317
Livingstone, Robert, Jr., 8337
Lofts, Brian, 8912
Logvinenko, B.M., 9014
Longhurst, A.R., 8684, 9021
Lopukhina, A.M., 9005
Lorz, H.W., 8700
Lowe, Charles H., 8306
Lowry, Gerald R., 8417, 8851
Ludke, J. Larry, 8806
Ludwig, S.A.M., 8789
Luk'yanenko, V.I., 8527, 8740, 8930
Lux, Fred E., 8774
Lyakhnovich, V.P., 8921
Lyubitskaya, A.I., 8936

MacGregor, John S., 8602
Mackett, David J., 8704
MacLeod, J.C., 8543
Mac Phee, Craig, 8812
Magnin, Etienne, 8924
Magnuson, John J., 8938
Mahdi, Mahmoud Ahmed, 8599
Maher, F.P., 8361
Malinin, L.K., 8966
Malyutin, V.S., 8953
Mamiya, Kiroko, 8492
Manar, Thomas A., 8301
Manges, Daniel E., 8359
Manning, Glenville T., 8671
Mansueti, A.J., 8643
Manteifel, B.P., 8955
Manzer, J.I., 8960
Marchetti, Roberto, 8485
Margolis, L., 8406
Maris, P.J., 8933
Mark, R.F., 8611
Marking, Leif L., 8626, 8627
Markowski, S., 8756
Martin, George T., 8341
Martin, N.V., 8362, 8395, 8815
Mason, Jack, 8557
Mason, James E., 8325
Mason, John C., 8564
Mason, John W., 8762
Mathur, Daya Swarup 8531
Matlin, Nathaniel A., 8816
Matsumoto, Haruyoshi, 8455

Mayhew, James, 8990
McBay, L. Glenn, 8764
McClane, A. J., 9025
McComish, Thomas S., 8827
McCoy, Edward G., 8367
McCoy, Elizabeth, 8745
McCracken, F. D., 8991
McCrimmon, Hugh R., 8563, 8675, 8811
McDonald, Arthur L., 8514
McDonald, D. B., 9008
McFarland, William N., 8381
McGilvrey, Frank B., 8348
McGrath, H. J. W., 8857
McHugh, J. L., 8875
McKechnie, Robert J., 8760
McKinney, Ted D., 8424
McMillan, D. B., 8743
McNeil, William J., 8777, 8838
Mead, James F., 8747
Meade, Thomas G., 8511
Meehan, William R., 8601, 8775
Meiring, P. G. J., 8636
Mepham, T. B., 8999
Meshkov, M. M., 8923
Meyer, F. P., 8473, 8631, 8634
Miesch, A. T., 8617
Millemann, Raymond E., 8329, 8820
Millen, Eduardo, 8948
Miller, C. W., 8807
Miller, Grover C., 8896
Miller, John A., 8855
Miller, John M., 8313
Miller, Robert Rush, 8306
Mills, Harlow B., 8981
Mitchell, B. S., 8552
Mitchell, Charles T., 8566
Mityushkin, V. A., 8953
Mizelle, John D., 8474
Moe, Martin A., Jr., 8341
Molnar, K., 8932
Mordukhai-Boltovskoi, F. D., 8748
Morgan, N. C., 8860
Morokuma, Hisako, 8457
Morris, Robert W., 8507
Moseley, Frank N., 8770
Mount, Donald I., 8637, 8824, 8852, 9020
Mountford, Kent, 8733
Mraz, Donald, 8899
Mulcahy, Marie F., 8463
Mullan, James W., 8828
Munz, Frederick W., 8381
Murphy, George E., 8806
Murphy, Glenn W., 8549
Myerson, Ralph M., 8945

Nadkarni, V. B., 8946
Nandi, Jean, 8707
Narver, David W., 8427, 8569
Neave, Nancy M., 8800
Needham, Robert G., 8597
Neil, E. H., 8308, 8751
Nelson, J. M., 8679
Nelson, William R., 8840
Neustroev, G. V., 8957, 9000
Nichols, Paul R., 8335, 8778, 8895
Nichols, Warren W., 8951
Nicholson, H. Page, 8647
Nigrelli, Ross F., 8344
Nikiforov, N. D., 8515
Nikolaeva, V. M., 8934
Nikol'skii, G. V., 8746
Nikolyukin, N. I., 8992
Nils-Arvid, Nilsson, 8352
Nishikawa, Tetsusaburo, 8954
Nishiyama, Tsuneo, 9007
Nordlie, Frank G., 8667
Norris, David O., 8521
Northcote, T. G., 8700, 8802
Nose, Takeshi, 8492
Novak, Arthur F., 8716
Novikov, P. I., 8902
Novotny, Anthony J., 8327
Nyberg, Peter A., 8329
Nyman, L., 8949

Oakley, Arthur L., 8885
Oberg, K. E., 8498
O'Connell, R. L., 8890
Oertle, V. Lee, 8605
Ogilvie, D. M., 8464
Ohno, S., 8499
Olla, Bori L., 8897
Olson, Donald E., 8846
Olson, Robert E., 8579
O'Rourke, Fergus J., 8463
Orrell, Russell F., 8338
Orska, Janina, 8532
Oseid, Donovan M., 8436
Osipova, I. V., 8922
Otis, Maurice B., 8658
Otsuru, Masamitsu, 8500
Ozaki, Hisao, 8458, 8459

Padgett, Herbert R., 8734
Paiva, Melquiades Pinto, 8993
Paloheimo, J. E., 8465, 8673, 8787
Paloma, Pedro A., 8757
Pappas, George S., 8887
Parameswaran, S., 8390
Parisot, Thomas J., 8635
Parker, Jack C., 8314
Parker, Robert R., 8410, 8788, 8994
Parrish, B. B., 8985
Parry, Gwyneth, 8888
Partin, Luther, 8360
Pate, D. A., 8345
Pathak, M. D., 8973
Patten, Benjamin G., 8772
Patten, Bernard C., 8867

Patton, D.K., 8486
Paul, Robert M., 8715
Paulik, G.J., 8813
Pearson, Roger E., 8466, 8670
Peery, Charles H., 8624
Peluse, Michael, 8951
Persov, G.M., 8903
Peters, John C., 8487
Peterson, Durey H., 8814
Petrenko, L.A., 8467, 8939
Pflieger, William L., 8883
Phillips, Arthur M., Jr., 8317
Pickering, Quentin H., 8639, 8640
Pickford, Grace E., 8912
Piggins, D.J., 8364
Pillay, T.V.R., 8389
Pinkas, Leo, 9019
Podlipalin, Yu. D., 8918
Podymakhin, V.N., 8957, 9000
Poinsard, F., 8542
Pollock, R.D., 8444
Pongsuwana, Umpol, 8551
Porter, L.R., Jr., 8774
Posewitz, Jim, 8656
Post, George, 8322, 8792
Poston, Hugh A., 8317
Power, Geoffrey, 8674, 8961
Pratt, Ivan, 8511
Prazdnikov, E.V., 8931
Prescott, John H., 8938
Pritchard, Austin W., 8906
Privol'nev, T.I., 8995, 8996
Prokov'eva-Bel'govskaya, A.A., 8503, 8750
Prosyanik, L.V., 8921
Protasov, V.R., 8540, 8966, 8918, 8955
Putz, R.E., 8321, 8331, 8508, 8583, 8632
Pycha, Richard L., 8396

Rabinowitz, Joseph L., 8945
Randall, D.J., 8450
Rao, M.R. Ramachandra, 8716
Rascovich, Mark, 8343
Rashceheperin, V.K., 8540
Rasheed, Suraiya, 9004
Rattray, Maurice, Jr., 8889
Rawstron, Robert R., 8804
Redmond, Malcolm, A., 8580
Reed, Edward B., 8943
Reed, Roger J., 8780, 8825
Regan, Danny M., 8697
Regier, H.A., 8435
Reid, George K., 8541
Reif, Charles B., 8956
Reimers, Norman, 8326
Reith, A.D., 8684
Remorov, V.A., 8534
Reynolds, James B., 8488
Rickards, William L., 8710
Ricker, W.E., 8407
Ridgway, George J., 8574
Riedel, Dietmar, 8862
Ritchie, Douglas E., 8387
Rivas, Luis R., 8545, 8705
Robbins, Otis, Jr., 8891
Roberts, E., 8799, 8801
Roberts, John L., 8472
Roberts, Larry S., 8615
Robinson, Paul F., 8869
Robson, D.S., 8435
Roeder, Martin, 8967
Roeder, Rachel H., 8967
Roelofs, E.W., 8405
Rogers, Wilmer A., 8577, 8614
Romanenko, E.V., 8918
Romine, Cynthis, 8908
Rosen, Donn Eric, 8975
Rosengren, E., 8479
Rosier, Carl, 8338
Ross, A.J., 8858
Rounsefell, George A., 8829
Rovertson, O.H., 8907
Royer, L.M., 8669
Rucker, R.R., 8858
Ruf, M., 8925
Ruggieri, George D., 8344
Ruggles, C.P., 8654
Rupp, Robert S., 8580, 8686

Saddler, James B., 9013
Sahashi, Yoshikazu, 8954
Saila, Saul B., 8394
Saito, Yutaka, 8500
Sakuda, Henry M., 8555
Sanders, Herman O., 8441
Sarig, S., 8546
Sathyanesan, A.G., 8937, 8980
Sato, Akiko, 8500
Saunders, R.L., 8388, 8366, 8800
Savage, George M., 8814
Schaefer, Milner B., 8613
Schaefer, Richard H., 8661
Scheier, Arthur, 8554, 8866, 8968
Schiffman, R.H., 8523
Schmidt, P.J., 8552
Schmidt, Ralph A., 8874
Schneider, Carl R., 8430
Schoettger, Richard A., 8628
Schoffman, C.S.V., 8309
Schoffman, Robert J., 8582
Schouwenburg, W.J., 8850
Schroeder, Elizabeth H., 8769
Schultz, Vincent, 8356
Schumacher, Robert E., 8448
Schwartz, Frank J., 8767
Schwassman, Horst O., 8544
Scott, William W., 8878
Seibert, D.L.R., 8684

Servizi, J.A., 8832
Shapley, S. Philip, 8393
Shekhvatov, Boris, 8685
Shelbourn, J.E., 8413
Shell, E.W., 8765
Shelton, J.M., 8444
Shelton, William L., 8497
Shepard, M.P., 8960
Sheridan, William L., 8601
Sherman, Kenneth, 8773
Shetter, David S., 8437
Shilo, M., 8546
Shiomi, Motoaki, 8525
Shooner, Gilles, 8674
Sieburth, John McN., 8879
Siefert, Richard E., 8893
Simco, Bill A., 8969
Singh, S.B., 8986
Sinnhuber, R.O., 8372, 8725
Siuda, Stanislawa, 8744
Skea, Jack, 8659
Skulberg, Anton, 8826
Skutsch, G.M., 8742
Sloan, Phillip R., 8399
Smith, Allen J., 8864
Smith, Bernard R., 8600
Smith, C. Lavett, 8759
Smith, Lloyd L., Jr., 8320, 8426, 8436, 8543, 8753
Smith, L.S., 8450, 8790
Smith, M.W., 8999
Smith, William B., 8368
Sneed, Kermit E., 8908
Snieszko, S.F., 8501, 8855, 8876
Snow, Howard, 8589
Sobel, Matthew J., 8618
Solomon, Gordon, 8495
Solovkina, L.N., 8505
Sorenson, Leroy, 8556
Spodniewska, Irena, 8752
Sprague, J.B., 8388
Springer, Stewart, 8839
Squire, James L., Jr., 8550
Sreenivasan, A., 8952
Stainer, I.M., 8620
St. Amant, James A., 8371
Stang, Joann C., 8666
Starkey, Roland J., 8626
Starrett, William C., 8981
Stebbings, Bruce E., 8646
Stempniewski, Helio L., 8948
Stenius, C., 8499
Stennis, John H., 8348
Stephan, Charles E., 8852
Strel'tsova, S.V., 8962
Stevens, E. Don, 8302
Stevens, Joe B., 8809, 8884
Stewart, Nelson E., 8820
Stokes, R.M., 8496
Stone, E.T., 8832
Story, Albert H., 8538
Straškraba, Milan, 8689
Straty, Richard R., 8836
Strout, Richard G., 8452
Sugihashi, Takao, 8971
Sukhoi Van, P.G., 8997
Sukumaran, K.K., 8390, 8986
Sultanov, S.Z., 8516
Summerfelt, Robert C., 9001
Sundararaj, Bangalore I., 8783
Surinovich, R.M., 8921
Sutherland, K., 8678
Suzuki, Takao, 8954
Swanson, George A., 8893
Swedberg, Donald V., 8334, 8763
Swee, U Boon, 8811
Swift, D.R., 8392
Sytina, L.A., 8481

Tabb, Durbin C., 8872
Tait, Howard D., 8328
Takamatsu, Chiaki, 8954
Talbot, Gerald B., 8871
Tanaka, Masanori, 8457
Tanner, Howard A., 8357, 8495
Tanonaka, George K., 8470
Tappa, Donald W., 8956
Tash, Jerry C., 8893
Taub, Stephen H., 8460
Tavolga, William N., 8608
Taylor, Zack, 8595
Teasley, John I., 8647
Templeman, Wilfred, 9024
Terao, Toshiro, 8455, 8456
Tharratt, Robert C., 8369
Thomas, Bill, 8623
Thomas, James C., 9019
Thomas, John L., 8805
Thomas, N.A., 8890
Thommen, H., 8911
Threinen, C.W., 8589
Tibbs, J., 8385
Toner, E.D., 8586
Topp, Robert W., 8333
Tremblay, Leon, 8959
Troadec, J.P., 8542
Tsuyuki, H., 8552, 8799, 8801
Tsvetkov, V.I., 8540
Tucker, Harold H., 8786, 8797, 8798
Tugarina, P. Ya., 8517
Turnage, Don, 8950
Turner, Charles H., 8370
Turner, Jerry L., 8873
Turner, Neely, 8506
Tyo, Robert M., 8570

Uchiyama, Masaaki, 8455
Ueda, Kazuo, 8376
Unger, Iris, 8625
Ursin, Erik, 8998

U.S. Bureau of Sport Fisheries and Wildlife, 8881
U.S. Fish and Wildlife Service, 8681
Ushiyama, Munehiro, 8971
Uspenskaya, A., 8478
Uthe, J.F., 8799, 8801
Utter, Fred M., 8574
Uzmann, Joseph R., 8432

Van Valin, Charles C., 8646
Vanstone, W.E., 8788
van Vuuren, L.R.J., 8636
Vernon, E.H., 8332, 8909
Vinnikov, Ya. A., 8922
Von Geldern, Charles E., Jr., 8761
Von Sallmann, Ludwig, 8965
Vrooman, Andrew M., 8757

Wagner, H.H., 8940
Wahle, Roy J., 8834
Walburg, Charles H., 8840
Wales, J.H., 8372
Walker, Bobby T., 8729
Walker, C.E., 8848
Walker, Charles R., 8526, 8626
Walker, Roland, 8528
Ward, F.J., 8741
Warinner, J.E., 8638
Warnick, Donald C., 8598
Warren, James W., 8574
Warrne, L.O., 8374
Waters, Charles A., 8425
Watts, D.C., 8742
Wayman, C.H., 8617
Weaver, Charles R., 8422
Webb, Kenneth L., 8380
Wedemeyer, Gary, 8692
Welch, Eugene B., 8687
Weldon, L.W., 8346
Wellborn, Thomas L., Jr., 8614
Wellings, S.R., 8941
West, Jerry L., 8644
Westerfield, Michael, 8484
Wetzel, Robert G., 8592, 8593
Wexler, Bernard C., 8907
Wiley, W.L., 8397
Wilson, G.G., 8672
Wilson, Peter C., 8910
Wimpenny, R.S., 8915
Winn, Howard E., 8886
Wistrom, Clarence, 8589
Withler, I.L., 8414
Witty, Kenneth, 8565
Wold, Finn, 8970
Wolf, Ken, 8528, 8630, 8880
Wolfert, David R., 8837
Wood, Edward M., 8553
Wood, James W., 8635
Wood, Langley, 8453
Woodall, A.N., 8462, 8629
Woodhead, A.D., 8972
Woolcott, William S., 8653
Wydoski, Richard S., 8668

Yamaguchi, Sunao, 8457
Yamazi, Isamu, 8695
Yarzhombek, A.A., 8947
Young, Parke H., 8759
Youngstead, Norman, 8561
Yuen, Heeny S.H., 8447

Zabegalina, N.A., 8493
Zacharewicz, Frank, 8908
Zaitsev, Yu. P., 8904
Zarnecki, Stanislaw, 8905
Zelinka, Milos, 8722
Zenzes, M.T., 8499
Ziebell, Charles D., 8568
Zilberberg, Mark H., 8771
Zimmer, Paul D., 8776
Zuckerman, B.M., 8807
Zurbuch, Peter E., 8386

SUBJECT INDEX

Age and growth,
bass, smallmouth, Detroit River, Iowa, 8488
bluegill, Reelfoot Lake, 8582
carp, 8810, 9009
catfish,
channel, 8924, 8969
hybrids, 8558
centrarchids, Folsom Lake, California, 8369
crappie, white, Reelfoot Lake, 8309
Dolly Varden, 8844
drum, freshwater, Missouri River reservoir, 8334
food and temperature factors, 8673
kingfish, northern, 8661
Lewis and Clark Lake, 8840
management, harvest, 8465
otoliths, terminology, 8720
pike, northern, 8793, 8919
production possibilities, 8737
related to food, 8787
salmon,
Atlantic, 8939
food habits, 8505
hatchery and wild, 8467
chum, 8407
sockeye, 8470, 8736
snapper, red, 8770
tarpon, 8830
temperature effect, 8998
trout,
brook, 8317, 8609
cutthroat, Trapper's Lake, 8607
lake, 8815, 9018
rainbow,
scale formation, 8530
stocking, 8572
upper Mississippi backwaters, 8753
walleye, 8662
warm-water stream, Michigan, 8723
Anatomy,
bass, striped, ocean and river specimens, 8483
catfish phylogeny, 8730
eye, light screening pigment, 8382
optic lobes, 8611
otoliths,
salmonids, 8958
terminology, 8720
pike, northern, 8922
salmon,
chinook, 8946
chum, 8989
Pacific, visual pigments, 8688
pink, scales, 8670
scales, 8407
vertebral abnormalities, 8443
Anatomy, cont.,
scale formation, rainbow trout, 8744
shad, American, fin ray and scute count, 8335
skin neoplasms, soles, 8941
testes, cytochemical study, 8537
Tilapia, 8535, 8782
trout,
color, 8814
head, 8619
rainbow,
fin ray variation, 8532
scale formation, 8530
swimbladder, 8479
vertebrae, 8795

Behavior,
acoustic vibrations, 9014
agnostic, interspecific, 8514
aquaria fish, freshwater, 8489
barracuda, 8486
bluefish, light and heat, 8897
bonito, Pacific, 8939
bullhead, vertical adjustment, 8990
eel, effect of light, 8868
effect of stimuli on attack readiness, 8539
goby, round, acoustic signals, 8540
hearing, 8608
homing migrations, 8584
light intensity, 8955, 8985
perch, yellow, daily winter movements, 8303
pressure, effect, 9007
reproduction, 8975
salmon,
Atlantic, light, 8676
coho,
habitat preference, 8398
migration, 8411
sockeye, migration, 8411
schooling, 9006
sharks, 8486
signalling, 8966
sounds produced, 8918
Tilapia,
color changes, 8751
Hawaiian ponds, 8308
trout,
brook, light, 8676
rainbow,
habitat preference, 8398
light, 8675
Benthos,
consumption and fish production, 8687
estuarine macrofauna, England, 8340
primary production, stream, 8890
Scottish stream animals, 8860

Bibliography,
culture, brackish-water fish, 8389
Dolly Varden, 8315
estuaries, eastern U.S., 8337
flounder, winter, 8333
Great Lakes, 8603
lymphocystis disease, 8344
marking with chemicals, 8882
pike, northern, 8586
radio-ecology, 8356
tunas, 8339
Biocides,
algacides, copper sulfate, 9008
effects,
on fish and wildlife, 8681
on man and environment, 8926
herbicides,
dichlobenil, dicamba on alligator-weed, 8345
diquat, 8346, 8349
effect on aquatics, 8526
paraquat, 8346
pentachlorophenate, PCP, 8457
silvex, 8348, 8421
sodium arsenite, 8645
tordon, 8982
2,4-D into Pseudomonas, 8692
insecticides,
aquatic invertebrates, 8597
Co-ral, dylox, malathion, 8429
DDT, 8440, 8464, 8506, 8780, 8857
diazinon, 8807
dieldrin, 8531
endrin, 8439, 8570, 8650, 8716, 8806
heptachlor, 8646
in British agriculture, 8494
lindane, 8531, 8933
Louisiana streams, 8647
parathion, 8807
Phosphamidon, 8850
Sevin, 8659, 8820
TDE, 8933
molluscicides,
Bayer 73, 9002
N-tritylmorpholine, 9002
pesticides, 9020
daphnids, 8441
residues in fish, 8715
piscicides,
Alaska lake, 8775
antimycin, 8699
DMSO, 8945
lamprey larvicides, 8310, 8864
management, 8719
nitrosalicylanilides, 8626
nonyl phenol ethoxylate, 8485
polychlorpinene, 8901, 8916
p,p'-DDT as reference, 8627
rotenone, 8498, 8573, 8749
salmon eggs, 8947
Biocides, cont.
piscicides, cont.
toxaphene, 8573, 8596, 8597, 8598, 8599, 8600, 8601, 8669

Chemical factors,
algal growth in alkaline waters, 8592
ATP, effect on perch, 8385
cadmium sulfate, 8852
dissolved oxygen, 8962, 8969
fission products uptake, 8438
hydrogen sulfide, channel catfish, 8821
metal cyanides, 8430
oxygen depletion, Florida lake, 8541
oxygen need, 8420
pH and zinc toxicity, 8637
phenol, 8740
pollution, 8610, 8636
polychlorpinene, 8510
salinity,
red tide in Barnegat Bay, 8733
sedimentation, coastal sound, 8367
tolerances, 8995
toxicity of heavy metals, 8640
Competition,
char and trout for food in lakes, 8352
rainbow trout and coho salmon, habitat, 8398
trout, sculpin, minnow--for stream food, 8689
Culture,
automatic feed dispensers, 8557
bass, striped, 8360
bowfin, 8567
brackish-water fish, bibliography, 8389
carp, 8948, 8986, 9009
catfish, channel, 8969
char, stocking, 8533
controlled heat, oxygen, water flow, 8564
control of hatchery parasites, 8712
diet,
bass, striped, 8562
salmon, 8512
esocid fishes, 8556
feeding equipment, pellet-forming, 8327
fish in Thailand rice fields, 8551
hybridization bases, 8992
ponds, 8921
recirculation unit, 8563
Russia, 9012
salmon,
Atlantic,
mortality, 8655
Sweden, 8739
chum, 8373, 8413
diet in Russia, 8714
in sea water, 8711

Culture, cont.
salmon, cont.
Russia, 8713
sockeye, 8569
trout,
brown, 8972
rainbow, 8984
walleye, infertile egg detection, 8846
warmwater fishes, 8621

Diet,
aflatoxins in cottonseed meal, 8725
bass, striped, 8562
carp, 9009
dry, meat supplemented, 8762
force-feeding system, 8327
growth efficiency, 8787
influence of green aquatic plants, 8754
iron and growth rate, 8967
penicillin mycelium meal, 8948
salmon,
chinook, hard animal fat, 8553
chum, vitamin E, 8456
pond-bred, 8512
Russia, 8714
trout,
beef liver, 8954
brook, calorie and protein, 8317
color, 8814
essential fatty acid, 8971
hepatoma, 8372, 8495, 8964
rainbow, flatfish meal, 8492
thioacetamide, 8965
vitamin antimetabolites, 8887
Disease,
Aeromonas, rainbow trout, 8792
algal antibacterials, 8879
antibodies against pathogenic bacteria, 8527
associated fungi, 8878
black spot, 9016
catfish, white, Pseudomonas, 8473
Clostridium botulinum,
Great Lakes, 8745
rainbow trout, 8826
epizootiology of bacterial diseases, 8876
Gymnodinium,
breve, red tide, 8829
flavum, yellow tide, 8829
hepatoma, 8855
ichthyophthiriasis, 8631
immunization shiner, 9001
infectious pancreatic necrosis, 8630
lymphocistis disease, 8344
malachite green, 8863
mycobacteriosis, 8635
pernicious anemia, Russian salmonids, 8516

Disease, cont.
pike, cancer, 8463
pseudomonads, identification, 8501, 8877
redmouth, 8858
"salmon poisoning", 8329
Saprolegnia, rainbow trout, 8792
skin neoplasms, soles, 8941
trout,
furunculo-septicaemia, 8500
hepatoma, 8372, 8495, 8964
hexamitiasis, 8322
lens cataract, 8965
Myxosoma cerebralis, 8321
Vibrio-disease, 8458, 8459
viral, 8880, 8984, 8988
Distribution,
bluefish, 8734
Eastern Pacific, 8550
herring, Atlantic, 8781
Kentucky, Green River Basin, 8549
Lake Palourde, Louisiana, 8950
Lake Superior bottom species, 8642
Louisiana bayou, 8729
Newfoundland marine fishes, 8976
Putnam County, Indiana, 8976
rare species, Western States, 8898
reservoir, Louisiana, 8726
salmon, pink, British Columbia, 8976
shad, threadfin, Tampa Bay, 8728
South Carolina coastal streams 8548
Virginia Island bay, 8732
Virginia streams, 8653
Ditches and channels,
channelization,
Montana streams, 8487
North Carolina streams, 8368
stream, 8658
estuaries, 8874
vegetation control, manatee, 8304
Drugs,
ammonia, Dactylogyrus, 8478
Dipterex, 8546
Dylox, 8561
Enheptin, toxicity, 8322
kanamycin, oxytetracycline, 8473
malachite green, 8500, 8863
metopiron, 8783
M.S. 222, 8767
nitrofuran derivatives, Vibrio-disease, 8458
ozone for Saprolegnia control, 8816
parasites of corral fishes, 8519
phenol, 8740, 8930
Quininae Hydrochloridum, 8525
thyroid, 8972

Ecology,
bass, striped, 8871
biocides, 8926

Ecology, cont.
catfish, channel, 8924
estuaries and coastal areas, eastern U.S., 8337
estuarine ecosystem, 8870
Florida coastal marsh, 8771
Illinois River, 8981
mackerel, jack, 8602
pike, northern, 8589
salmon, Atlantic, 8738
seatrout, spotted, 8872
trout, Gila, 8697
Economics,
angler success as factor, 8809
bait minnows, Tennessee, 8384
fishways, Maine, 8576
longlining, marine game fishes, 9022
national survey of 1965, 8881
pollution control benefits, 8884
reservoirs, 8978
sulfite pollution, 8755
trout,
fishing, 8624
pond construction, 8894
Electricity,
conductivity of fish, 8354
electrofishing shocker, 8772
Embryology,
bluefish, 8643, 8904
eggs in paraffin oil, 8693, 8917
growth related to parent and egg size, 8996
hatching of eggs, 8923
lamprey, sea, 8743
light and hatching, 8936
muskellunge, periblast nuclei, 8522
salmon,
Atlantic, 8318, 8515, 8750, 8957, 9000
hybrid, chum x pink, 8482
sockeye, 8736
salmonid,
cell nucleus, 8503
incubation apparatus, 8564
trout,
brook, 8330, 8560, 8785
brown, 8560
rainbow, 8499, 8785
walleye, 8320, 8846
Equipment,
apparatus, incubation, 8564
bag, plastic, transport, 8556
controlled seawater system, 8453
dispensers, feed, automatic, 8557
disposable aquaria, 8324
electrofishing shocker, 8772
floating tent trap, 8859
food pellet machine, 8327
kits, detergent determination, 8617
measuring large samples, 8403
Equipment, cont.
net, sampling, ocean surface, 8524
photographic and sonar, 8397
press, salmon scale, 8678
sampler, plankton, 8684
seine, purse, miniature, 8566
sonic, tracking large fish, 8343
tags, disk, application, 8649
toxicology study, flowing waters, 9020
trapping downstream migrants, 8325
ultrasonic transmitter, 8808
unit, recirculation, 8563

Farm ponds,
herbicides,
diquat, 8349
sodium arsenite and silvex, 8421
Fertilization,
culture ponds, 8920
effect of pool bottom material, 8765
eutrophication of Russian lake, 8493
Food habits,
aerial insects along a stream, 8679
alewife, 8379
bass,
largemouth, 8828
striped, 8805
bluegill, 8653
buffaloes, 8827
carp, 8810, 8927
consumption, production-pond fish, 8687
Dolly Varden, 8427, 8825
drum, freshwater, 8763
eels, 8342
lamprey, brook, 8703
marine fishes, 8817
pike, northern, 8404, 8793, 8794
salmon,
Atlantic, 8505
Pacific, 8406
sockeye, 8700
snapper, red, 8770
sunfish, green, 8405
trout,
brook, 8943
brown, 8342
cutthroat, 8851
lake, 8448, 8815
rainbow, 8817
walleye, 8578, 8819, 8837, 8847

Genetics,
catfish hybrids, 8558
centrarchids, 4-genera hybridization, 8644
hybridization bases, 8992
pike family hybrids, 8319, 8402
salmon,

Genetics, cont.
salmon, cont.
Atlantic x brown trout, 8364
chum x pink, 8482
chum x sockeye, 8455
stemline chromosomes, 8951
trout,
brook and splake, 8559
brown x brook, 8942
brown x Atlantic salmon, 8364
cutthroat x golden, 8935
cutthroat, inbreeding, 8574
rainbow-cytological study, 8499

Habitat improvement,
introduction food organisms, 8354, 8448
marine,
reefs, 8625
wreck, 8731
mowing needs, 8983
reducing acidity of streams, 8386
stream channeling, 8658
trout,
impoundment, New York, 8894
stream, gabions, 8378
Harvest,
albacore, 8721
Bear Lake, Idaho-Utah, 8691
California,
freshwater, 8760
marine, 8704, 9019
Cape Canaveral area, 8336
catfish, channel, 8764
drum, freshwater, 8418
effect of growth, 8465
Flathead Lake, 8891
Folsom Lake, 8804
Lake Erie, 8920
Lake Tahoe, 8758
longlining, 9022
Pacific game fishes, 8550
pike, northern, 8794
salmon,
coho, 8823
pink, 8433
trout,
brook, 8609, 8812
cutthroat, 8606, 8812
tuna, 8461, 8613

Identification,
bass, largemouth and spotted, young, 8449
general, 8490
herring, Atlantic, 8781
otoliths, salmonids, 8958
pickerels, 8307
salmonids, Russian, 8727
sharks, Western Atlantic cat, 8839

Identification, cont.
trout, brook and lake, 8381
tunas, 8339

Life history,
bass, smallmouth, 8488
char,
Arctic, 8425
Windermere, 8520
grayling, Amur, 8481
inconnu, 8953
mackerel, jack, 8602
perch, white, Quabbin Reservoir, 8460
pickerel, grass, 8899
pike, northern, 8589
shad, gizzard, 8835
suckers, longnose and white, 8802
Limnology,
Colorado trout lake, 8607
density, depth, stability relationship, 8377
fertilization, eutrophication of Russian lake, 8493
Great Lakes, bibliography, 8603
hydroelectric diversions, 8831
Lewis and Clark Lake, 8893
Nicaragua, 8862
primary productivity of stream, 8581
reservoirs, southern India, 8952

Management,
alewife, Great Lakes, 8357
bass, striped, 8360, 8871
beaver, trout, 8845
bluegill, Reelfoot Lake, 8582
California, marine, 9019
chub, Utah, 8491
estuaries,
east coast, 8874
general, 8875
Sacramento - San Joaquin, 8873
fish barrier, 8326
Florida, freshwater, 8705
food organisms, Swedish lakes, 8353
freshwater fishes, 8571
grayling, 8517
green plants and vitamins, 8754
growth, relative to harvest, 8465
hydroelectric diversions, 8831
lake, fertilization, 8493
Lake Tahoe, 8758
lamprey, sea, Great Lakes, 8358
mackerel, jack, 8602
marine reefs, 8625
muskellunge, 8595
pike, northern, 8589
piscicides, 8596, 8626, 8669, 8719
research publications, 8347
reservoirs,
Federal areas, 8355

Management, cont.
reservoirs, cont.
Fort Peck, pike, 8656
Oklahoma small watershed projects, 8502
subimpoundments, Sweden, 8351
water levels, 8350, 8919
salmon,
Atlantic, 8468, 8665, 8739
passage facilities, 8813
pink, harvest, 8433
stabilized stream flows, 8848
stream, Alaska, 8338
Salton Sea, 8605
screen, downstream diversion, 8849
seismic survey, effects, 8865
shad, Susquehanna River, 8363
splake, Canada, 8362
stocking, reservoir, 8748
Tilapia, behavior, 8308
trout,
brook, Montana, 8657
fee fishing, 8624
gabions, 8378
impoundment, 8894
lake, Ontario, 8815
regulations, effect, 8437
water level fluctuations, 8752
Marking,
anchovy, northern, 8757
bass, striped, 8778
cod, Atlantic, 8822, 8991
fin clips, partial, 8663
marine fish tagging program, 8604
perch, yellow, 8853
population analysis, 8664
preparing dart tags, 8766
salmon, Atlantic, 8467
shad, American, 8778
survival differential, 8994
tags,
dart, Dolly Varden, 8590
disk, 8649
internal plastic, 8555
loss, 8435
tunas, 8900
with chemicals, 8882
Migration and movement,
bass, striped, 8484
bluefish, 8734
chub, Utah, 8491
cod, Atlantic, 8993
Dolly Varden, 8316, 8590
downstream diversion screen, 8849
fishways, Maine, 8576
Folsom Lake, 8804
grayling, Amur, 8481
Gulf of Mexico, 8313
homing migrations, 8584
Lake Superior, bottom fishes, 8642
Migration and movement, cont.
marine fishes, 8604
neurosecretion, role of, 8707
perch, yellow, under ice, 8303
salmon,
Atlantic, 8366, 8388, 8738, 8902, 8903, 8939, 8959
chinook, 8376, 8813, 8886
chum, 8476
coho, 8376, 8411, 8565, 8677
Columbia River, 8776, 8834
Pacific, 8825
pink, 8332, 8445, 8476, 8960
sockeye, 8411, 8813, 8836
seatrout, spotted, 8872
suckers, longnose and white, 8802
tautog, 8641
trout,
brook, 8559
brown, 8587
cutthroat, 8417, 8791
lake, Lake Superior, 8396
rainbow, 8414
splake, 8559
tunas, 8900, 8993
ultrasonic transmitter, 8808

Oceanography,
albacore harvest, 8721
estuaries,
classification, 8889
sedimentation, dredging, 8367
Florida red tide, 8829
Hawaii research, 8301
hydrography, Gulf of Mexico, 8312
Pacific,
charts, 8685
eastern tropical, 8779
plankton, 8380, 8773
pollution, California coast, 8370
salinity, east Pacific, 8612
surface,
sampling net, 8524
temperature, Western Atlantic, 8769
tuna, yellowfin, surface temperatures, 8542
zooplankton-oxygen relation, 9021

Parasites,
Achtheres, 8633
Argulus, 8632
bass, 8431, 8474
black spot disease, 9016
blood, marine fish, 8452
bluegill, 8536
Bolbophorus confusus, 8579
carp, 8546
catfishes, 8634, 8896
catostomids in Alabama, 8577

Parasites, cont.
coral fishes, 8519
crappie, white, 8615
cryptobia salmositica, 8416, 8446
cyathocotylids, 8666
Dactylogyrus, 8478
diplostomatosis in trout ponds, 8547
effects on fishes, 9015
Entamoeba gadi, 8616
Ergasilus, 8615, 8633
European river fishes, 8914
flier, 8583
Gyrodactylus, new species, 8614
Holostephanus, 8666
Ichthyophthirius multifilis, 8631, 8824
lamprey, Pacific, 8475
leeches, 8974
ligula immunization, 8932
liver worms, 9005
marine, England, 8756
Myxosoma cartilaginis, 8508
Nanophyetus salmincola, 8329
nomenclature, spiruroid nematodes, 9004
Octospinifer maceleutis, sucker, 8480
pike, northern, 8682, 8709
Plistophora, trout, shad, 8331
pollock, 8616
reservoirs, Russia, 9003
Salmincola, 8633
salmon,
Atlantic, sea lamprey, 8818
Russian hatcheries, 8712
salmonid leech, life history, 8400
salmonids, fresh-water pearl mussel, 8454
sucker, Pennsylvania, 9017
Tetraonchus monenteron, 8682
trematodes,
bass, 8474
eyes, 8913
marine, 8934
trout,
cutthroat, 8432, 8511
digestive tract, 8518
rainbow, 8432, 8511
Physical factors,
channelization, Montana streams, 8487
Illinois River, 8981
light,
effect on behavior, 8955, 8985
green sunfish, 8405
skeleton development, 8936
salmon, Atlantic, temperature, 8515
sediment,
Alaska stream, 8393
in spawning gravel, 8444
temperature,
Physical factors, cont.
temperature, cont.
Arctic char, 8392
goldfish physiology, 8784
oxygen and trout development, 8785
trout physiology, 8747
thermal acclimation, Atlantic salmon, 8464
toxaphene, effect of temperature, 8599
tuna, yellowfin, surface temperature, 8542
whitefish, Lake Erie, 8401
wind action, estuary sediment, 8367
Physiology,
accumulation I^{131}, 8908
amino acid transport, 8999
blood, 8790, 8906, 8931, 9001, 9011
bluegill, 8513
bullhead,
black, 8667
yellow, 8507
carbonic anhydrase, 8929
carp, digestion, 8927
Chesapeake fishes, 8869
effects,
temperature change on blood, 8784
time on toxicity, 8944
electropherograms, 8801
endrin, effect on blood and tissue, 8439
eyes, light screening pigment, 8382
fatty acids, 9013
goldfish, sight discrimination, 8375
glycogen storage, 9005
haddock, 8680
hearing, 8608
hematocrit measurement, 8628
herring, blood sera, 8781
keto-carotenoids, 8911
lactate dehydrogenases, 8928
lamprey, sea, cardiac, 8706
liver, biochemical activity, 8742
metabolism, effect of food and temperature, 8673
methyl testosterone, 8912
neurosecretory system, 8782
optic tectum, 8544
osmotic,
adaptation, 8888
ionic regulation, 8940
oxygen need, 8420
phenolic intoxication, 8930
pike, northern, 8534
plankton, marine, 8399
pumpkinseed, 8472, 8554
response to stress, 8907
rotenone and respiration, 8498
salmon,

Physiology, cont.
salmon, cont.
Atlantic,
blood, 8786, 8797, 8798
bouyancy and water velocity, 8800
blood, 8391
coho, 8504
Pacific, scale growth, 8789
pink, 8509, 8788
scent and homing, 8376
sockeye,
maturation changes, 8842
oxygen consumption, 8408
swimming speeds, 8411
shad, American, swimming ability, 8422
sight, 8611
sucker, blood, 8724
Tilapia, hypophysectomy, 8707
trout,
comparative electropherograms, 8799
fatty acid pattern, 8747
rainbow,
anemia, 8585
blood,
characteristics, 8442
pressure and oxygen consumption, 8450
excretion of electrolytes, 8620
extract of pituitary glands, 8552
glucose transport, 8496
lecithinase activity, 8412
metabolism, 8302
muscular activity and blood, 8671
osmotic and ionic regulation, 8469
radiothyroidectomy, 8521
respiratory pumps in head, 8619
seasonal thyroid functions, 8451
strontium-calcium transport, 8523
swimbladder, 8479
thyroid, 8462
thyroidectomy, 8629
thyroid, 8744
tuna,
blood serum, 8305
swimming speeds, 8447
Plankton,
alewife, selection of food, 8379
Barnegat Bay red tide, 8733
food value, 8843
Gulf of Maine, 8773
marine, 8380, 8399, 8915
Plankton, cont.
Penilia avirostris, 8696
phyto-,
carbon assimilation and temperature, 8638
depth of lakes, 8690
Sandy Hook Bay, 8694
polychlorpinene, 8510
ponds, 8752
sampler, 8684
toxaphene, 8597
zoo-, New Jersey coast, 8695
Pollution,
algae floatation, 8636
alkyl benzene sulfonate, 8866, 8968
cadmium sulfate, 8852
control, recreational benefits, 8884
detergents, 8610, 8617, 8639
heavy metals, 8640
household refuse, 8860
Lake Tahoe, 8594
metal cyanides, 8430
paper pulp plant, 8832
population of fishes, 8722
primary productivity, 8861
pumpkinseed, ABS, 8554
radioactive material, bibliography, 8356
salmon,
Atlantic, base metal mine, 8388
pulp and paper wastes, 8568, 8672
sewage,
in ocean, 8370
in stream, 8359
Truckee River, 8890
stream sediment, Pacific salmon, 8841
strip mining, 8977
sulfite, 8755
turbidity, salmon production, 8885
walleye, wood fibers, 8320, 8426, 8436, 8543
water quality control, 8618
Populations,
analysis, marking, 8664
bass, largemouth, reservoirs, 8434
beaver pond trout, 8845
correlated with growth rate, 8654
effect of,
log driving, 8833
stream channelization, 8368
effective harvest of stream trout, 8812
estimating, 8686, 8796
fecundity and survival, 8746
Michigan warm-water stream, 8723
Mississippi backwaters, 8753
salmon,
Atlantic, Newfoundland river, 8468

Populations, cont.
salmon, cont.
pink,
Fraser River, 8332
related to food supply, 8477
sockeye, Adams River, 8741
salmonids, food and space, 8683
sewage treatment, 8722
shad, American, river distinction, 8335
Texas coastal inlet, 8311
tunas, Atlantic, 8910, 8993
warmwater stream, 8419
whitefish, lake, Lake Erie, 8401
Predation,
lamprey, brook, 8703
pike, northern, 8404
sculpin, pink salmon, 8601
smelt, American, 8956
walleye, 8847
Production,
catfish, channel, 8969
char, introduction in trout lakes, 8352
decline in estuarine habitat, 8870
effects of pollution, 8861
estimate from single-tagging experiment, 8529
estimating, a method, 8796
fertilization,
culture ponds, 8921
Russian lake, 8493
growth possibilities, 8737
pike, northern, 8794
primary,
aquatic plants and periphyton, 8593
influence of synthetic detergents, 8610
phytoplankton and lake depth, 8690
reservoirs,
Russia, 8748
southern India, 8952
salmon,
Columbia River, turbidity, 8885
pink, Fraser River, 8909
Puget Sound inlets, 8823
sex ratio, 8735
stream, Alaska, 8338
shallow estuary, Virginia, 8867
stream, Michigan warm-water, 8723
temperature and phytoplankton, 8638
Texas coastal inlet, 8331
Tilapia, 8862
trout,
brook-stream, 8609
cutthroat, 8424
tuna, bigeye, 8461

Radiobiology,
beta activity, 8979
bibliography, freshwater radioecology, 8356
biocides, 8945
Ce^{137}, 8937
Cs, 8925, 8957
damage of chromosomes, 8750
effect on physiology of goldfish, 8980
marine metabolism, 8717
radionuclides released in fresh water, 8538
Sr, 8925, 9000
trout, radiothyroidectomy, 8462
uptake, marine fishes, 8438
Y^{90}, 9000
Reproduction,
artificial spawning grounds, reservoirs, 8997
bass,
kelp, 8759
smallmouth, Ozark stream, 8883
striped, 8652, 8871
carp, 8390, 8811
catfish, induced spawning, 8783
char,
Arctic, egg development, 8392
Windermere, 8520
goldfish, 8561
guppy, 8561
induced spawning, 8986
lamprey, sea, 8743
modes, 8975
salmon,
Atlantic, 8735, 8996
chinook, sediment in spawning gravel, 8444
chum, culture, Hokkaido, 8373
other species at spawning, 8825
pink, 8365, 8445, 8477, 8777
sockeye, 8409, 8569, 8842
spawning, bed environment, 8838
stabilized flows, 8848
stream sediments, 8841
shad, threadfin, 8423, 8497
sounds made, 8918
trout,
brook, 8560, 8668
brown, 8560, 8587
cutthroat, 8417, 8424, 8606
rainbow, 8414
Research,
bleeding of fishes, 8648
estuarine ecology, needed, 8875
oceanography, Hawaii, 8301
paper mill toxicity on salmon, 8568
replicate culture pools, 8765
reporting, 8347
reservoir preimpoundment study, 8374
Science Information Exchange, 8328

Reservoirs,
algicides, copper sulfate, 9008
artificial spawning areas, 8997
bass,
parasites, 8431
populations, largemouth, 8434
California estuary, 8873
centrarchid growth, Folsom Lake, 8369
drum, freshwater, harvest, 8418
economics, 8978
Folsom Lake study, 8804
food habits,
bass, largemouth, 8828
buffalo, 8827
hatching of midges, 8859
hydroelectric, 8831, 8905
Lewis and Clark Lake study, 8840, 8893
management,
Federal areas, 8355
subimpoundment, Sweden, 8351
water level fluctuation, 8350
muskellunge as predator, 8595
New York trout, 8894
Oklahoma small watershed projects, 8502
parasites, Russia, 9003
perch, white, Quabbin, 8460
pike, northern, Fort Peck, 8656
piscicides, 8719
preimpoundment, bottom organisms, 8374
production,
India, 8952
Russia, 8748
species in a Louisiana,
drainage, 8729
impoundment, 8726
water level management, 8919

Sampling,
downstream migrants, 8325
electrofishing shocker, 8772
estimating mortality and recruitment, 8529
estuarine benthos, 8340
Gulf of Mexico, 8313
measurement, 8403
miniature purse seine, 8566
recovery error, 8415
salmon, pink, Fraser River, 8909
streams, warmwater, 8419
Tampa Bay, 8341
Texas coastal inlet, 8311
tuna, blood, 8305

Specific,
albacore, 8721
alewife, 8357, 8379
anchovy, northern, 8757

Specific, cont.
barracuda, ciguatera poisoning, 8545
bass,
kelp, 8759
largemouth, 8431, 8434, 8449, 8474, 8828
smallmouth, 8431, 8488, 8883
spotted, 8431, 8449
striped, 8360, 8387, 8483, 8484, 8562, 8652, 8778, 8805, 8871, 8895
white, 8761, 8808
bluefish, 8643, 8734, 8904
bluegill, 8513, 8536, 8582, 8645, 8646, 8653, 8749, 8906
bonito, Pacific, 8938
bowfin, culture, 8567
buffalo,
bigmouth, 8827, 8840
smallmouth, 8827, 8840
bullhead,
black, 8667, 8990
yellow, 8507, 8650
carp, 8564, 8810, 8811, 8840, 8854, 8948, 8962, 9009
Crucian, 8930
grass, 8390, 8927, 8986, 9009
silver, 8390, 8986
carpsucker, river, 8840
catfish,
channel, 8764, 8821, 8908, 8924, 8969
Indian, 8783
white, 8473
char,
Arctic, 8392, 8425
Windermere, 8520
chub, Utah, 8491
chubsucker, lake, 8323
ciscoe, Bonneville, 8691
cod, Atlantic, 8822, 8991
crappie, white, 8309, 8615
Dolly Varden, 8315, 8316, 8427, 8590, 8825, 8844
drum, freshwater, 8334, 8418, 8763
eel, American, 8868
flier, 8583
flounder,
summer, 8774
winter, 8333, 8394
goby, round, 8540
goldfish, 8375, 8561, 8573, 8784, 8963, 8980, 8999
grayling, 8481, 8517, 8974, 9010
guppy, 8561
haddock, 8680
herring, Atlantic, 8781, 8985
inconnu, 8953
kingfish, northern, 8661
lamprey,

Specific, cont.
lamprey, cont.
brook, 8703
Pacific, 8475
sea, 8358, 8600, 8706, 8743, 8818
mackerel, jack, 8602
minnow, fathead, 8639
mosquitofish, 8806
mummichog, 8912
muskellunge, 8522, 8595
perch,
common, 8385
white, 8460
yellow, 8303, 8598, 8817, 8853
pickerel,
grass, 8307, 8899
redfin, 8307
pike, northern, 8404, 8428, 8463, 8534, 8586, 8589, 8682, 8693, 8709, 8793, 8794, 8919, 8922
pollock, 8616
pumpkinseed, 8472, 8554, 8866, 8968
salmon,
Atlantic, 8318, 8366, 8388, 8440, 8464, 8467, 8468, 8505, 8515, 8591, 8655, 8665, 8672, 8674, 8738, 8739, 8750, 8786, 8797, 8798, 8800, 8818, 8902, 8939, 8949, 8957, 8958, 8959, 8996, 9000
chinook, 8376, 8444, 8553, 8718, 8803, 8813, 8886, 8907, 8946
chum, 8373, 8407, 8413, 8456, 8476, 8711, 8713, 8714, 8789, 8803, 8838, 8989
coho, 8376, 8398, 8411, 8415, 8446, 8504, 8565, 8677, 8698, 8803, 8823, 8850, 8892, 8940, 8947, 9013, 9025
pink, 8332, 8365, 8407, 8410, 8433, 8445, 8466, 8476, 8477, 8509, 8670, 8711, 8713, 8714, 8777, 8788, 8789, 8803, 8832, 8838, 8841, 8903, 8909, 8931, 8960
sockeye, 8361, 8383, 8391, 8397, 8408, 8409, 8411, 8470, 8569, 8654, 8700, 8736, 8741, 8775, 8789, 8803, 8813, 8832, 8833, 8836, 8841, 8842, 9023
seatrout, spotted, 8872
shad,
American, 8335, 8422, 8778
gizzard, 8331, 8835
Kerch, 9014
threadfin, 8423, 8497, 8728
shark, bonito, 8575
shiner, golden, 9001
smelt, American, 8580, 8956
Specific, cont.
snapper, red, 8770, 8944
snook, 8710
splake, 8362
sucker,
longnose, 8802
white, 8480, 8802, 9017
sunfish, green, 8405
tarpon, 8830
tautog, 8641
Tilapia, 8308, 8371, 8535, 8707, 8751, 8782, 8862
trout,
brook, 8317, 8330, 8381, 8386, 8437, 8559, 8560, 8609, 8657, 8668, 8676, 8785, 8795, 8812, 8943, 8961
brown, 8342, 8385, 8437, 8560, 8572, 8587, 8659, 8689, 8693, 8702, 8727, 8911, 8917, 8958, 8972, 8974
cutthroat, 8417, 8424, 8432, 8511, 8574, 8606, 8607, 8791, 8812, 8851, 8906
Gila, 8697
lake, 8381, 8396, 8448, 8815, 8929, 9018
rainbow, 8302, 8321, 8322, 8331, 8372, 8391, 8398, 8412, 8414, 8432, 8442, 8450, 8451, 8458, 8459, 8462, 8469, 8479, 8485, 8492, 8495, 8496, 8499, 8500, 8511, 8521, 8523, 8530, 8532, 8552, 8572, 8585, 8620, 8622, 8623, 8624, 8629, 8671, 8676, 8744, 8747, 8785, 8792, 8795, 8816, 8817, 8826, 8855, 8858, 8907, 8917, 8954, 8962, 8964, 8965, 8970, 8971, 8984, 8987, 8988, 9011
tuna,
bigeye, 8461
bluefin, 8910
skipjack, 8447
yellowfin, 8447, 8542
walleye, 8320, 8426, 8436, 8543, 8578, 8662, 8819, 8837, 8846, 8847
whitefish, lake, 8401, 8799
Stocking,
bass, white, in California, 8761
char, 8352, 8533
good and bad, 8588
Lake Tahoe, 8758
muskellunge, 8595
Pennsylvania, 8621
reservoir, Russia, 8748
river, Russia, 8953
salmon,
Atlantic, 8591
coho, eastern states, 8892, 9025

Stocking, cont.
salmon, cont.
pink, 8365, 8509
sockeye,
Alaska lake, 8856
eastern waters, 8361, 8383, 9023
Salton Sea, 8605
smelt, American, 8580
Tilapia,
California, 8371
Central America, 8862
toxicant measurement of rehabilitated lake, 8669
trout,
lake, in Lake Superior, 8396
New Zealand lake, 8856
rainbow, 8572, 8622
stream formula, 8660
Survival,
bass, smallmouth, Ozark stream, 8883
drum, freshwater, 8418
estimation from tagging, 8529
Folsom Lake fishes, 8804
hybrid, Atlantic salmon x brown trout, 8364
iron in diet, 8967
Survival, cont.
marked fish, 8994
salmon,
adverse spawning environment, 8838
Alaska stream, 8777
Atlantic, 8655
chinook, 8444
controlled flows, 8848
pink, 8365, 8410
sedimented spawning beds, 8841
siesmic survey, 8865
trout,
brook, 8609
rainbow, 8442, 8469, 8485
returned, 8651
varying diets, 8762
walleye, wood fibers, 8543

Vegetation,
alligatorweed, 8345, 8348
duckweed, azolla, 8346
farm ponds, 8421
manatee used in control, 8304
toxic to fish, 8471

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